

Biological Evaluation

U.S. Department of Agriculture Forest Service

**Laurentian Ranger District
Superior National Forest
Aurora, Minnesota**



Biological Evaluation for the Proposed NorthMet Project and Land Exchange

April 2015

NorthMet Project and Land Exchange

U.S. Department of Agriculture Forest Service

Laurentian Ranger District
Superior National Forest
Aurora, Minnesota

April 2015

NorthMet Project and Land Exchange

Biological Evaluation

U.S. Department of Agriculture Forest Service
Laurentian Ranger District
Superior National Forest
Aurora, Minnesota

April 2015

Prepared by: _____
Stuart Lindsey Paulus, Ph.D., Wildlife Ecologist

Date:

Reviewed by: _____
Dan Ryan, Wildlife Ecologist

Date:

Reviewed by: _____
Jason Butcher, Aquatic Ecologist

Date:

Reviewed by: _____
Jack Greenlee, Forest Plant Ecologist

Date:

Executive Summary

Poly Met Mining Inc. (PolyMet) proposes to construct an open pit mine in northern Minnesota to extract low- to medium-quality copper-nickel-PGE minerals with low sulfide content. This project, called the NorthMet Project (Project), is located in St. Louis County on the eastern end of the Mesabi Iron Range, about 60 miles north of the City of Duluth, and 6 miles south of the City of Babbitt, Minnesota. The Project areas include the Mine Site (3,015 acres), Plant Site (4,515 acres), and Transportation and Utility Corridors (120 acres) that connect the Mine Site to the Plant Site.¹

PolyMet plans to mine and process polymetallic ore from the northwestern portion of the Duluth Complex, a rock formation that forms much of the bedrock of northeastern Minnesota. The ore contains copper, nickel, gold, platinum, palladium, and cobalt. The Project would mine ore for approximately 20 years, using open pit mining methods similar to those currently in use at ferrous metallic mining operations on the Iron Range. The Plant Site was previously used as a taconite processing facility by the LTV Steel Mining Company (LTVSMC). PolyMet would upgrade existing facilities and construct new facilities to produce copper concentrates, nickel concentrates, and base and precious metal precipitates for off-site shipment and treatment. Tailings from ore processing would be placed in a tailings basin built atop the existing LTVSMC taconite tailings basin.

About 1,719 acres of the Mine Site would be directly disturbed by mining activities. Of these, 1,667 acres are administered by the Forest Service and 52 acres are privately owned. Habitats on the federally administered lands that would potentially be affected by the project include upland coniferous forest (including black spruce², jack pine, and balsam fir), upland deciduous forest (including trembling aspen and paper birch), upland mixed coniferous/deciduous forest, coniferous bogs (including black spruce and tamarack), open bogs (including leatherleaf and Labrador tea), coniferous swamps (including black spruce, tamarack, and northern white cedar), hardwood swamps (including black ash), shrub swamps (including speckled alder, willows, and dogwoods), marshes (including cattails), and sedge and wet meadows (including sedges and grasses). A variety of plants and animals, including several species of concern, have been observed on or near the Mine Site. A 2014 Forest Service study confirmed that northern long-eared bats and little brown bats utilize the Mine Site and adjacent Project areas (USDA Forest Service 2014a).

Of the approximately 3,015 acres on the Mine Site, approximately 2,719 acres are owned by the United States (U.S.) Government (Government) and administered by the U.S. Department of Agriculture (USDA) Forest Service (Forest Service). In addition, about 3,776 acres adjacent to the Mine Site are owned by the Government and administered by the Forest Service.

The Forest Service is considering transferring these approximately 6,495 acres (federal lands) to PolyMet in exchange for lands (non-federal lands) of similar value that have been offered for consideration by PolyMet. All

¹ Acreages given in this report are based on Geographic Information System (GIS) analysis. Acreages associated with the legal descriptions of the lands are based on original surveys performed by the Bureau of Land Management, Government Land Office (GLO) surveyors between 1858 and 1907. As such, GLO acreages are used as part of the project description for the Final Environmental Impact Statement (FEIS) being prepared for the Project and would also be used to define the real estate transaction if the Land Exchange Proposed Action was approved. The analysis of effects presented in this Biological Evaluation (BE) is based upon GIS data. GIS values indicate the actual size of the parcels discussed in this BE, which may be different than the GLO legal acreage.

² Common and scientific names of plants and animals given in this report are provided in **Appendix A**.

EXECUTIVE SUMMARY

lands potentially involved in the land exchange would be independently appraised according to the Uniform Appraisal Standards for Federal Land Acquisitions. The appraisals would determine the market value of the properties. Information collected during wildlife and wetland functions and values studies would be used by the Forest Service in the land exchange appraisal, and would be used to evaluate impacts to wetlands, and wildlife and their habitats, for a Final Environmental Impact Statement (FEIS) for the Project and land exchange.

Assuming a land exchange occurs, the portions of the Mine Site, Dunka Road and Utility Corridor, and lands adjacent to the Mine Site that are administered by the Forest Service would no longer be part of the National Forest and therefore would not be subject to Forest Service management plans and policies. A land exchange for land adjustment is consistent with the 2004 *Land and Resource Management Plan for the Superior National Forest* (2004 Forest Plan).

To fulfill land exchange requirements, PolyMet is proposing to purchase and transfer all or a portion of 7,075 acres of non-federal lands to the Forest Service. The non-federal lands consist of the Hay Lake Lands (4,926 acres), Hunting Club Lands (160 acres), Lake County Lands (382 acres), McFarland Lake Lands (31 acres), and Wolf Lands (1,576 acres). All lands are dominated by second-growth deciduous and coniferous forest habitats and a variety of plants and animals, including several species of concern, have been observed on or near the non-federal lands.

Assuming a land exchange occurs, the non-federal lands would be administered by the Forest Service. The non-federal lands are associated with four Forest Plan Management Areas, as designated by the Forest Service, which include General Forest, General Forest – Longer Rotation, Riparian Emphasis Area, and Candidate Research Natural Areas. If all or portions of the non-federal lands are acquired by the Forest Service, they would be administered by the Forest Service to meet the goals of these management areas.

The Project could adversely impact plant and animal species of concern found on or near the federal lands. The 2004 *Forest Plan Revision Final Environmental Impact Statement for Chippewa and Superior National Forests* (2004 Forest Plan EIS) assessed plant and animal species identified by the Regional Forester for which population viability was a concern as evidenced by:

- Significant current or predicted downward trends in population numbers or density.
- Significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution (Forest Service Manual 2670.5).

Based on the 2004 Forest Plan EIS and subsequent updates, the Regional Forester identified 12 non-vascular plants, 46 vascular plants, 2 aquatic invertebrates, 6 insects, 4 fish, 1 reptile, 8 birds, and 5 mammals as Regional Forester Sensitive Species (RFSS). Of these, eight vascular plants, and six (and possibly nine as unidentified bat species have been reported on the federal lands) animals have been reported on the federal exchange lands, while two vascular plants and two (and possibly up to five as unidentified bat species have been found on the non-federal exchange lands) animals have been reported on the non-federal lands.

This Biological Evaluation (BE) was prepared to document RFSS populations and habitat use on or near the federal and non-federal lands, and potential direct, indirect, and cumulative impacts to these species from the Project. This BE complies with Forest Service Manual Directives 2671.1 through 2672.43 and the National

Forest Management Act of 1976. The Forest Service Manual Directive 2672.42 objectives for completing BEs for proposed Forest Service programs and activities are to:

- ensure that Forest Service actions do not contribute to loss of viability of any native or desired non-native plant or animal species,
- ensure that Forest Service activities do not cause any species to move toward federal listing, and
- incorporate concerns for sensitive species throughout the planning process, reducing negative impacts to species and enhancing opportunities for mitigation.

In addition to addressing impacts to RFSS from the Proposed Action, which includes the Project and land exchange, this BE also addresses impacts to RFSS from two alternatives also considered in the FEIS:

- Land Exchange Alternative B (Alternative B) - under Alternative B, the Forest Service would transfer 4,753 acres of federal lands, which comprise 2,719 acres at the Mine Site and a smaller amount of federal land surrounding the Mine Site, to PolyMet in exchange for the 4,926-acre Hay Lake Lands. This land exchange would involve the transfer of a similar acreage, would provide wetlands to the Forest Service, and Hay Lake Lands would have a higher-per-acre value than the federal lands.
- Land Exchange No Action Alternative (No Action Alternative) - under the No Action Alternative, mine construction, development, and operation would not occur and no lands would be exchanged. The Government would not convey federal lands to PolyMet, and the Forest Service would continue managing these federal lands.

Based on the analyses for this BE, the Forest Service has determined that the Proposed Action and Alternative B would have **no impact** to the following RFSS:

Plants

Alpine milkvetch	Lanceleaf grapefern	Scotch false asphodel
<i>Arctoparmelia centrifuga</i>	Largeleaf sandwort	Short sedge
<i>Arctoparmelia subcentrifuga</i>	Little goblin moonwort	Smooth woodsia
Braun's holly fern	Long-leaved arnica	Sticky locoweed
Creeping rush	Maidenhair spleenwort	Triangle grapefern
Chilean sweet-cicely	Moschatel	Wain's cup lichen
Douglas' hawthorn	Nodding saxifrage	
Encrusted saxifrage	Oakes' pondweed	

Animals

Lake sturgeon	Nipigon cisco	Shortjaw cisco
---------------	---------------	----------------

EXECUTIVE SUMMARY

The Forest Service determined that the Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for the following RFSS:

Plants

American shoreweed	<i>Cetraria aurescens</i>	New England sedge
American waterawlwort	Cloudberry	Pale moonwort
Appalachian clubmoss	Common moonwort	Peppered moon lichen
Auricled twayblade	Fairy slipper	Quill spikerush
Barren strawberry	Fan lichen	Ram's head lady slipper
Beard lichen	Floating marsh marigold	Roughfruit fairybells
Bog muhly	Honeycombed lichen	Selwyn's scalewort
Bog white violet	Least moonwort	Small beggerticks
<i>Caloplaca parvula</i>	Leiberg's waterlily	Snowline wintergreen
Canada ricegrass	Linear-leaved sundew	Ternate grapefern
Canada yew	Michigan moonwort	Western Jacob's-ladder
Cartilage lichen	Moor rush	Yellow specklebelly

Animals

Bald eagle	Freija's grizzled skipper	Northern long-eared bat
Bay-breasted warbler	Gray wolf	Olive-sided flycatcher
Black sandshell	Great gray owl	Quebec emerald dragonfly
Boreal owl	Headwaters chilostigman caddisfly	Taiga alpine
Connecticut warbler	Little brown myotis	Three-toed woodpecker
Creek heelsplitter	Northern brook lamprey	Tri-colored bat
Eastern heather vole	Northern goshawk	Wood turtle
Ebony boghaunter		

EXECUTIVE SUMMARY

The Forest Service determined that the Proposed Action and Alternative B would have **no beneficial impact**, and **would not likely impact individuals or result in a trend to federal listing or loss of viability**, for any RFSS discussed in this BE.

Finally, the Forest Service determined that the No Action Alternative would have **no impact** on RFSS discussed in this BE.

A separate Biological Assessment (BA) was prepared to evaluate project effects to Canada lynx, a federally listed threatened species, and its critical habitat; northern long-eared bat, a RFSS species that was recently federally listed as threatened; and gray wolf, a RFSS species that was previously federally listed as threatened in 1977, delisted in 2011, and relisted December 19, 2014, following a federal court reversal of the USFWS decision to delist the gray wolf.

Contents

1.0 Introduction	1-1
1.1 Overview	1-1
2.0 Description of the Proposed Action and Alternatives.....	2-1
2.1 Proposed Action (Alternative A).....	2-1
2.1.1 Overview	2-1
2.1.2 Mine Site	2-1
2.1.3 Plant Site.....	2-8
2.1.4 Transportation and Utility Corridors	2-12
2.1.5 Traffic.....	2-15
2.1.6 Project Reclamation	2-16
2.1.7 Federal and Non-federal Lands	2-23
2.2 Land Exchange Alternative B (Alternative B).....	2-25
2.3 Land Exchange No Action Alternative (No Action Alternative)	2-26
3.0 Description of the Lands Affected by the Project.....	3-1
3.1 Federal Lands	3-1
3.1.1 Mine Site	3-1
3.1.2 Federal Lands Surrounding the Mine Site.....	3-15
3.2 Plant Site and Transportation and Utility Corridors	3-17
3.3 Non-federal Lands	3-17
3.3.1 Hay Lake Lands	3-17
3.3.2 Hunting Club Lands	3-18
3.3.3 Lake County Lands	3-18
3.3.4 McFarland Lake Lands	3-20
3.3.5 Wolf Lands.....	3-20
4.0 Biological Evaluation Methodology	4-1
4.1 Literature Review.....	4-1
4.1.1 Biological Evaluations	4-1
4.1.2 Other Sources of Information	4-1
4.2 Database Inquiries.....	4-2
4.3 Consultation with Biologists with Local Knowledge of the Species	4-2
4.4 Field Studies.....	4-2

TABLE OF CONTENTS

4.4.1	Federal Lands	4-2
4.4.2	Non-federal Lands.....	4-4
4.5	Determination of Effects.....	4-4
4.5.1	Types of Effects and Assessment Factors	4-4
4.5.2	Cumulative Effects.....	4-5
5.0	Analysis and Determination of Effects	5-1
5.1	Vascular and Non-vascular Plants	5-1
5.1.1	Plants Not Evaluated in the Biological Evaluation	5-1
5.1.2	Plants of Non-forested Wetlands, Shallow Water, and Riparian Areas (Habitat Group 1).....	5-1
5.1.3	Cliff, Talus Slope, and Exposed Rock Habitat (Habitat Group 2)	5-10
5.1.4	Upland Disturbed, Barrens, or Early Successional Forest Habitat (Habitat Group 3).....	5-14
5.1.5	Forested Wetland – Black Spruce, Tamarack, and Mixed Conifer Forest Habitat (Habitat Group 4).....	5-20
5.1.6	Mesic Hardwood Forest Dominated Habitat (Habitat Group 5).....	5-28
5.1.7	Dry-mesic Upland Forest: Deciduous, Coniferous, or Mixed Forest Habitat (Habitat Group 6)	5-32
5.2	Animals	5-37
5.2.1	Animals Not Evaluated in the Biological Evaluation	5-37
5.2.2	Mussels	5-37
5.2.3	Insects	5-40
5.2.4	Fish	5-48
5.2.5	Reptiles	5-50
5.2.6	Birds.....	5-53
5.2.7	Mammals	5-78
6.0	References.....	6-1

Appendixes

Appendix A	Common and Scientific Names of Plants and Animals Given in this Biological Evaluation
-------------------	--

List of Figures

1	Project Location.....	1-2
2	Federal and Non-federal Lands	1-4
3	Land Exchange – Proposed Action and Alternative B	1-5
4	Mine Site Plan.....	2-2
5	Plant Site Layout.....	2-8
6	Transportation and Utility Corridors.....	2-13
7	Mine Site Plan Long-term Closure	2-17
8	Plant Site Layout Long-term Closure	2-20
9	Management Indicator Habitat Types and Age Classes - Federal Lands	3-2
10	Management Indicator Habitat Types and Age Classes - Hay Lake Lands, Lake County Lands, and Wolf Lands 1 and 2	3-3
11	Management Indicator Habitat Types and Age Classes - Hunting Club Lands, McFarland Lake Lands, and Wolf Lands 3 and 4.....	3-4
12	GAP Land Cover/Habitat Types - Federal Lands.....	3-5
13	GAP Land Cover/Habitat Types - Hay Lake Lands, Lake County Lands, and Wolf Lands 1 and 2	3-6
14	GAP Land Cover/Habitat Types - Hunting Club Lands, McFarland Lake Lands, and Wolf Lands 3 and 4.....	3-7
15	Wetlands - Federal Lands.....	3-8
16	Wetlands - Hay Lake Lands, Lake County Lands, and Wolf Lands 1 and 2.....	3-9
17	Wetlands - Hunting Club Lands, McFarland Lake Lands, and Wolf Lands 3 and 4	3-10
18	Arrowhead Region of Minnesota and Ecological Subsections	4-7

List of Tables

1	Regional Forester Sensitive Species Occurrence and Habitat Availability on the Federal and Non-federal Lands.....	1-7
2	Maximum Pit Dimensions.....	2-4
3	Waste Rock Properties.....	2-5
4	Maximum Stockpile Dimensions - Approximate	2-5
5	GAP Cover Type and Management Indicator Habitat on Federal and Non-federal Lands.....	3-11
6	Management Indicator Habitat and Age Classes on Federal and Non-federal Lands	3-12
7	GAP Cover Types on Federal and Non-federal Lands	3-13
8	Wetland Types on Federal and Non-federal Lands	3-14
9	GAP Cover Types Affected by the Project at the Mine Site	3-16

List of Acronyms

BA	Biological Assessment
Barr	Barr Engineering, Incorporated
BE	Biological Evaluation
BWCAW	Boundary Waters Canoe Area Wilderness
CESA	Cumulative Effects Study Area
dbh	Diameter-at-breast-height
DDT	Dichlorodiphenyltrichloroethane
DPS	Distinct Population Segment
e.g.	For example
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FEIS	Final Environmental Impact Statement
Forest Service	U.S. Forest Service
GAP	Gap Analysis Program
GIS	Geographic Information System
GLO	Government Land Office
Government	United States Government
GPS	Global Positioning System
i.e.	In otherwords
kV	kilovolts
LTVSMC	LTV Steel Mining Company
MDNR	Minnesota Department of Natural Resources
mg/L	milligrams per liter
mi ²	square miles
MIH	Management Indicator Habitat
MPCA	Minnesota Pollution Control Agency
N/A	Not Applicable
NHIS	Natural Heritage Information System
NRRI	Natural Resources Research Institute
PolyMet	Poly Met Mining Inc.
Project	NorthMet Project
RFSS	Regional Forester Sensitive Species
ROW	Rights-of-way
SCUBA	Self-contained Underwater Breathing Apparatus
SEIS	Supplemental Environmental Impact Statement
SUV	Sport Utility Vehicle
Tracks Project	Tracks Forest Management Project
USDOI	U.S. Department of the Interior
U.S.	United States
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service

1.0 Introduction

1.1 Overview

Poly Met Mining Inc. (PolyMet) proposes to construct an open pit mine in northern Minnesota to extract low- to medium-quality copper-nickel-PGE minerals with low sulfide content. This project, called the NorthMet Mining Project (Project), is located in St. Louis County on the eastern end of the Mesabi Iron Range, about 60 miles north of the City of Duluth, and 6 miles south of the City of Babbitt, Minnesota. The Project areas include the Mine Site (3,015 acres), Plant Site (4,515 acres), and Transportation and Utility Corridors (120 acres) that connect the Mine Site to the Plant Site³ (**Figure 1**).

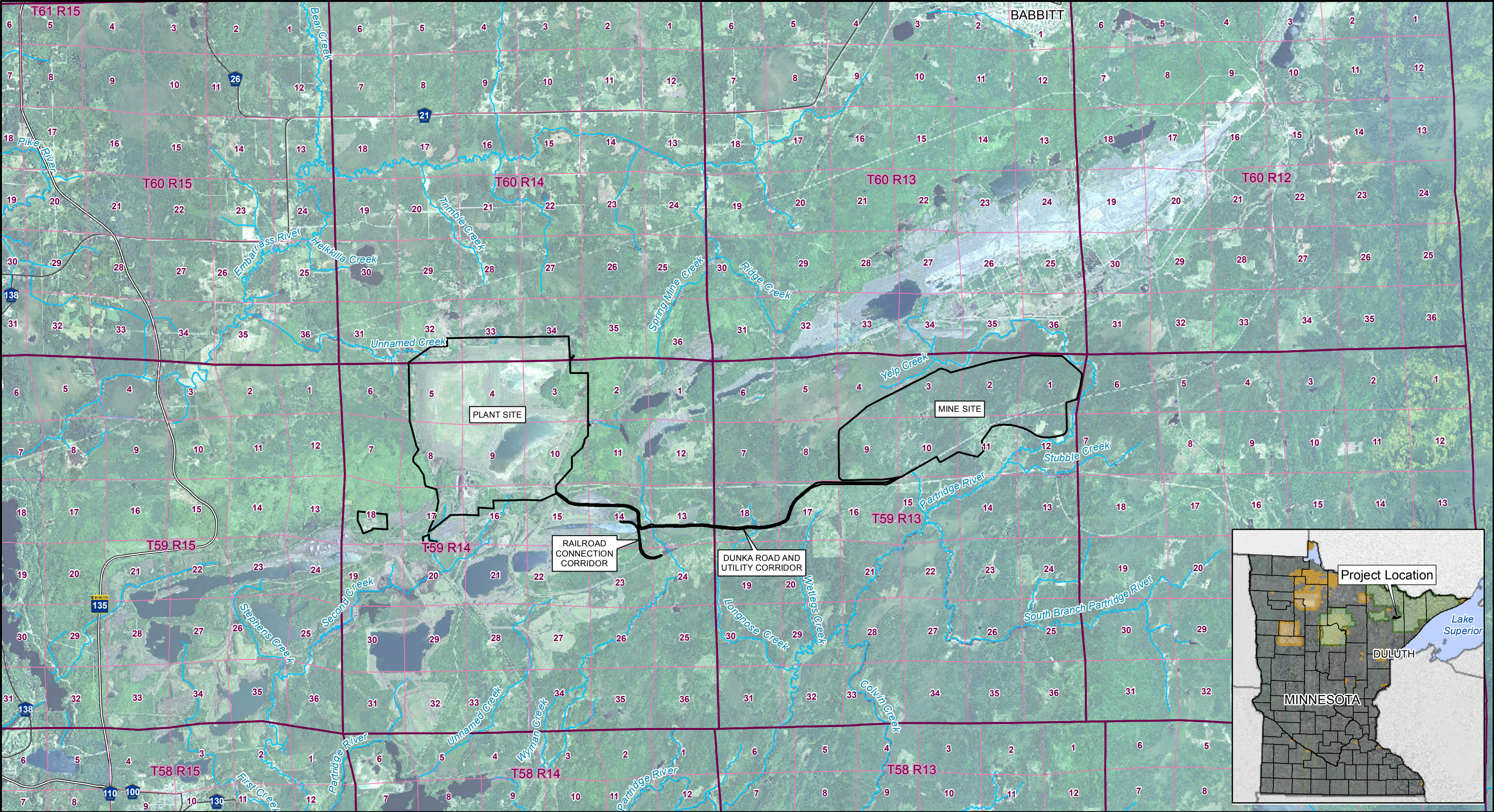
PolyMet plans to mine and process polymetallic ore from the northwestern portion of the Duluth Complex. The Duluth Complex is an ore complex that forms much of the bedrock of northeastern Minnesota. The ore contains copper, nickel, gold, platinum, palladium, and cobalt. The Plant Site was previously used as a taconite processing facility by the LTV Steel Mining Company (LTVSMC). PolyMet would upgrade existing facilities and construct new facilities to produce copper concentrates, nickel concentrates, and base and precious metal precipitates for off-site shipment and treatment. Because the Plant Site has been operated as an industrial facility for decades, the Project would not have significant new effects on wildlife habitat at the Plant Site.

About 1,719 acres of the Mine Site would be directly disturbed by mining activities. Of these, 1,667 acres are administered by the Forest Service and 52 acres are privately owned. Habitats on the federally administered lands that would potentially be affected by the project include upland coniferous forest (including black spruce⁴, jack pine, and balsam fir), upland deciduous forest (including trembling aspen and paper birch), upland mixed coniferous/deciduous forest, coniferous bogs (including black spruce and tamarack), open bogs (including leatherleaf and Labrador tea), coniferous swamps (including black spruce, tamarack, and northern white cedar), hardwood swamps (including black ash), shrub swamps (including speckled alder, willows, and dogwoods), marshes (including cattails), and sedge and wet meadows (including sedges and grasses). A variety of plants and animals, including several species of concern, have been observed on or near the Mine Site.

Of the approximately 3,015 acres on the Mine Site, approximately 2,719 acres are owned by the United States (U.S.) Government (Government) and administered by the U.S. Department of Agriculture (USDA) Forest Service (Forest Service). In addition, about 3,776 acres adjacent to the Mine Site are owned by the Government and administered by the Forest Service.

³ Acreages given in this report are based on Geographic Information System (GIS) analysis. Acreages associated with the legal descriptions of the Lands are based on original surveys performed by the Bureau of Land Management, Government Land Office (GLO) surveyors between 1858 and 1907. As such, GLO acreages are used as part of the project description for the Final Environmental Impact Statement (FEIS) being prepared for the Project and would also be used to define the real estate transaction if the land exchange was approved. The analysis of effects presented in this Biological Evaluation (BE) is based upon GIS data. The GIS values indicate the actual size of the Lands discussed in this BE, which may be different than the GLO legal acreage.

⁴ Common and scientific names of plants and animals given in this report are provided in **Appendix A**.



- Project Areas
- Township Lines
- Section Lines
- Rivers & Streams



0 0.5 1 2 Miles

Figure 1
Project Location
Biological Evaluation for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

INTRODUCTION

The Forest Service is considering transferring these approximately 6,495 acres (federal lands) to PolyMet in exchange for lands (non-federal lands) of similar value that have been offered for consideration by PolyMet (**Figures 2 and 3**). Assuming a land exchange occurs, the portions of the Mine Site, Dunka Road and Utility Corridor, and lands adjacent to the Mine Site that are administered by the Forest Service would no longer be part of the National Forest and therefore would not be subject to Forest Service management plans and policies. A land exchange for land adjustment is consistent with the 2004 *Land and Resource Management Plan for the Superior National Forest* (2004 Forest Plan; USDA Forest Service 2004a).

To fulfill land exchange requirements, PolyMet is proposing to purchase and transfer all or a portion of 7,075 acres of non-federal lands to the Forest Service under the Proposed Action (**Figure 2**). The non-federal lands consist of the Hay Lake Lands (4,926 acres), Hunting Club Lands (160 acres), Lake County Lands (382 acres), McFarland Lake Lands (31 acres), and Wolf Lands (1,576 acres). All lands are dominated by second-growth deciduous and coniferous forest habitats and a variety of plants and animals, including species of concern, have been observed on or near the non-federal lands.

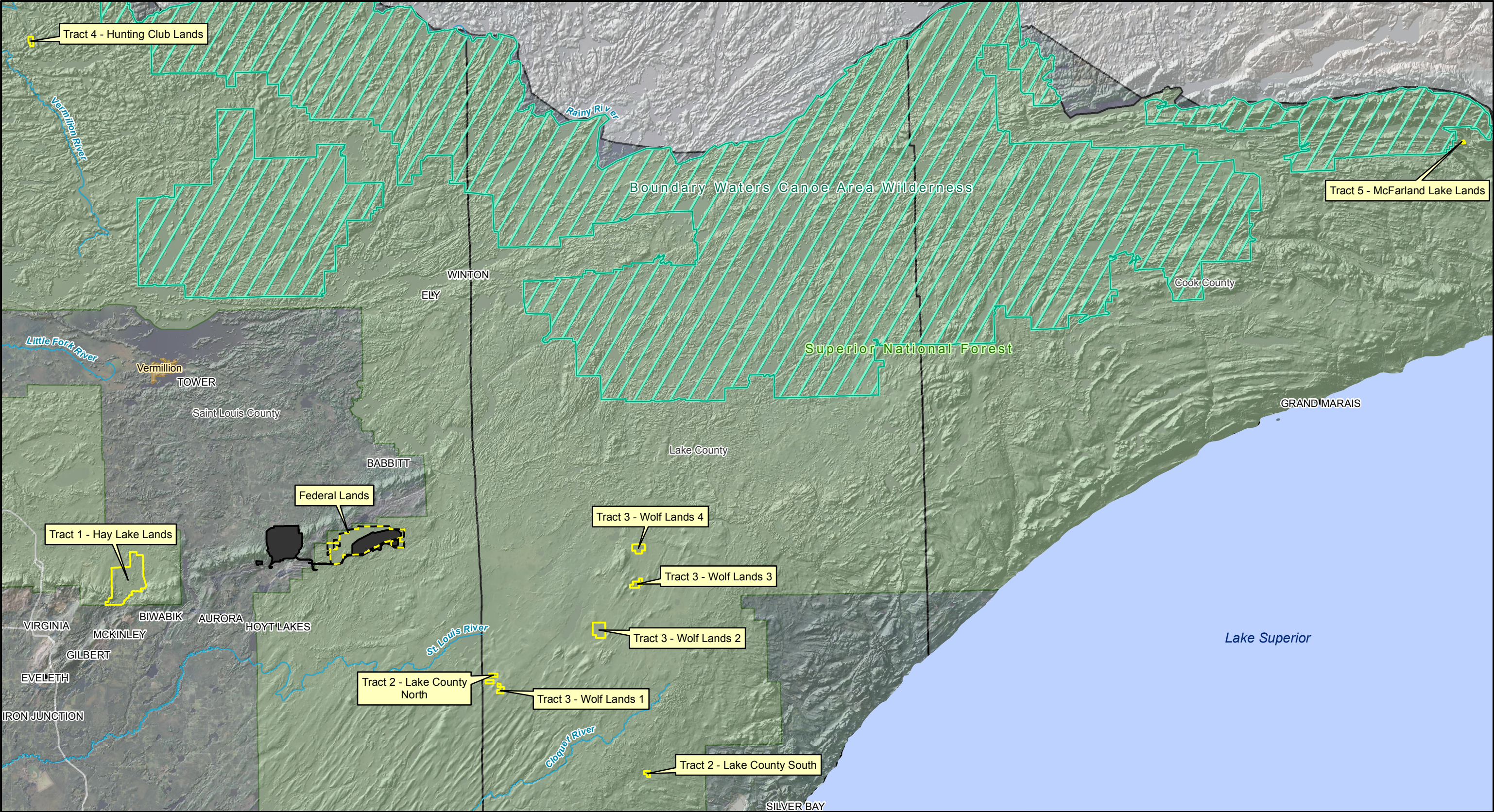
Assuming a land exchange occurs, the non-federal lands would be administered by the Forest Service. The non-federal lands are associated with four Forest Plan Management Areas, as designated by the Forest Service, which include: General Forest, General Forest – Longer Rotation, Riparian Emphasis Area, and Candidate Research Natural Areas. If all or a portion of the non-federal lands are acquired by the Forest Service, they would be administered by the Forest Service to meet the goals of these management areas (USDA Forest Service 2004a).

The Regional Forester or other authorized officer must decide if the proposed land exchange complies with the 2004 Forest Plan (USDA Forest Service 2004a), is a fair value exchange, and is in the public interest. All lands potentially involved in the land exchange would be independently appraised according to the Uniform Appraisal Standards for Federal Land Acquisitions. The appraisals would determine the market value of the properties. Information collected during wildlife and wetland functions and values studies would be used by the Forest Service in the land exchange appraisal, and would be used to evaluate impacts to wetlands, and wildlife and their habitats, for a *NorthMet Mining Project and Land Exchange Final Environmental Impact Statement* (FEIS) for the Project and land exchange (Minnesota Department of Natural Resources [MDNR] et al. 2015).

The Project could adversely impact plant and animal species of concern found on or near the federal lands. The 2004 *Forest Plan Revision Final Environmental Impact Statement for Chippewa and Superior National Forests* (2004 Forest Plan EIS; USDA Forest Service 2004b) assessed plant and animal species identified by the Regional Forester for which population viability was a concern as evidenced by:

- Significant current or predicted downward trends in population numbers or density.
- Significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution (Forest Service Manual Directive 2670.5; USDA Forest Service 2000a).

Table 1 provides information on species occurrence and habitat availability for the Regional Forester Sensitive Species (RFSS) on the federal and non-federal lands. Based on the 2004 Forest Plan EIS and

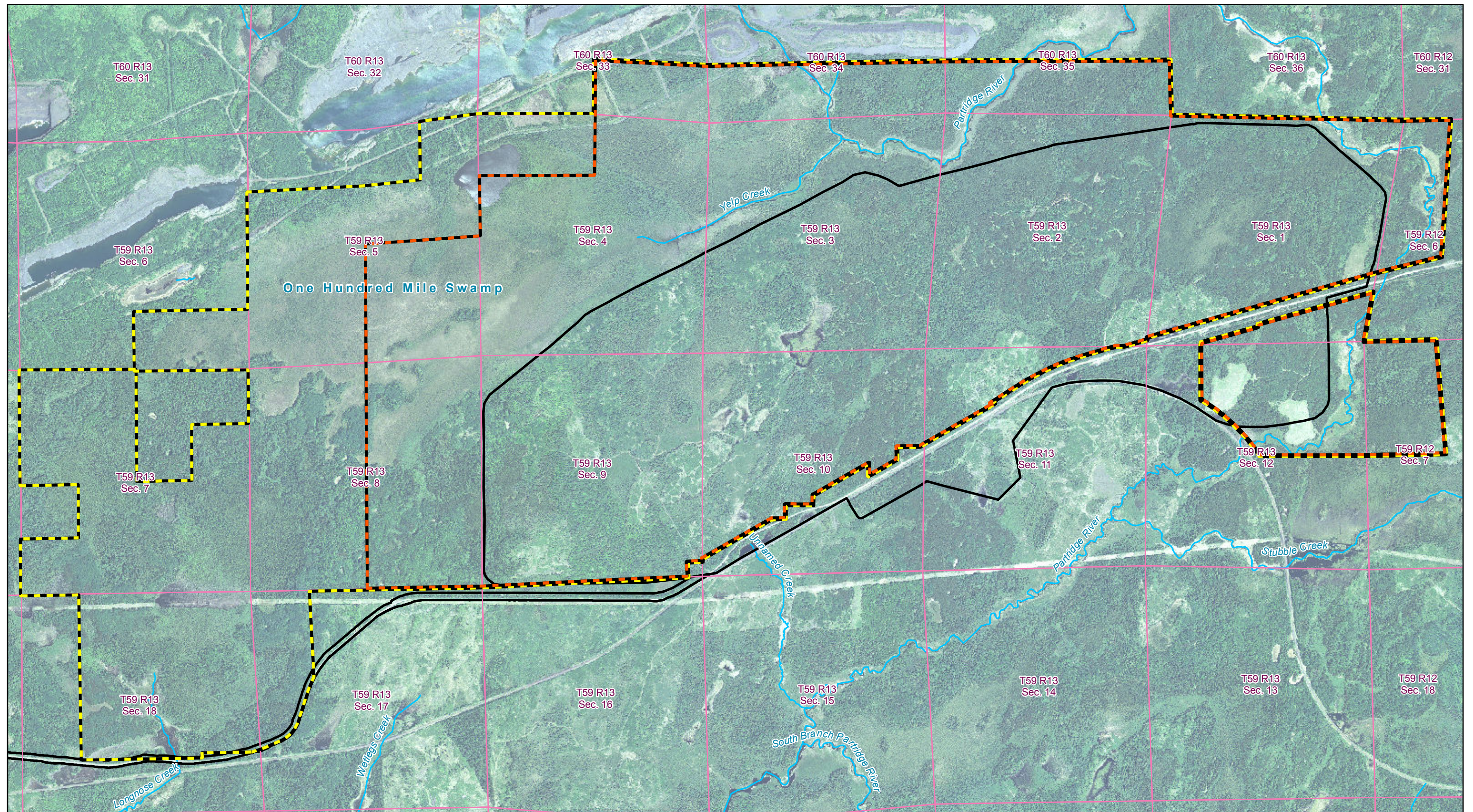






- Project Areas
- Federal Lands
- Non-federal Lands
- Boundary Waters Canoe Area Wilderness
- National Forest Boundary
- Native American Reservation
- Major River



0 3.75 7.5 15
Miles

Figure 2
Federal and Non-federal Lands
 Biological Evaluation for the NorthMet Project and Land Exchange
 St. Louis County, Minnesota



-  Project Areas
-  Federal Lands - Proposed Action
-  Federal Lands - Alternative B
-  Section Lines

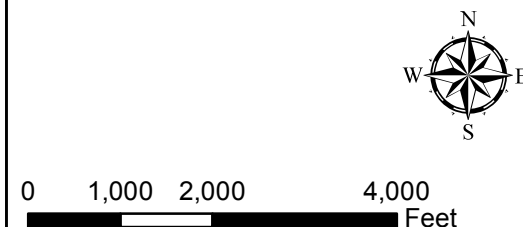


Figure 3
Land Exchange - Proposed Action and Alternative B
Biological Evaluation for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

subsequent updates, the Regional Forester identified 12 non-vascular plants, 46 vascular plants, 2 aquatic invertebrates, 6 insects, 4 fish, 1 reptile, 8 birds, and 5 mammals as RFSS (Ryan 2011). Of these, eight vascular plants, and six (and possibly nine as unidentified bat species have been found on the federal exchange lands) animals have been reported on the federal lands, while two vascular plants and two (and possibly up to five as unidentified bat species have been found on the non-federal lands) animals have been reported on the non-federal exchange lands (**Table 1**). If the known and potential habitat and species occurrences are listed as “No” for a RFSS in **Table 1**, the RFSS was not analyzed in this Biological Evaluation (BE).

In accordance with Forest Service Manual Directives 2671.1 through 2672.43 (USDA Forest Service 2000a) and the National Forest Management Act of 1976, the Forest Service is required to prepare a BE to:

- ensure that Forest Service actions do not contribute to loss of viability of any native or desired non-native plant or animal species,
- ensure that Forest Service activities do not cause any species to move toward federal listing, and
- incorporate concerns for RFSS throughout the planning process, reducing negative impacts to species and enhancing opportunities for mitigation.

In addition to addressing impacts to RFSS from the Proposed Action, which includes the Project and land exchange, this BE also addresses impacts to RFSS from two alternatives also considered in the FEIS:

- Land Exchange Alternative B (Alternative B) - under Alternative B, the Forest Service would transfer 4,753 acres of federal lands, which comprise 2,719 acres at the Mine Site and a smaller amount of federal land surrounding the Mine Site, to PolyMet in exchange for the 4,926-acre Hay Lake Lands (**Figure 3**). This land exchange would involve the transfer of a similar acreage, would provide wetlands to the Forest Service, and Hay Lake Lands would have a higher-per-acre value than the federal lands.
- Land Exchange No Action Alternative (No Action Alternative) - under the No Action Alternative, mine construction, development, and operation would not occur and no lands would be exchanged. The Government would not convey federal lands to PolyMet, and the Forest Service would continue managing these federal lands.

This BE was prepared to document RFSS populations and habitats on or near the federal and non-federal lands, and likely direct, indirect, and cumulative impacts to these species from the Project. A separate Biological Assessment (BA) was prepared to evaluate project effects to Canada lynx, a federally listed threatened species, and its critical habitat; northern long-eared bat, a RFSS species that was recently federally listed as threatened; and gray wolf, a RFSS species that was recently re-listed as federally threatened, and its critical habitat (U.S. Army Corps of Engineers [USACE] and USDA Forest Service 2013). While the Canada lynx, northern long-eared bat, and gray wolf are discussed in this BE, the *NorthMet Mining Project and Land Exchange Biological Assessment Draft* provides additional details on these species (USACE and USDA Forest Service 2013).

Table 1

Regional Forester Sensitive Species Occurrence and Habitat Availability on the Federal and Non-Federal Lands

RFSS Species		Species and Habitat Occurrence				Habitat Characteristics
Scientific Name	Common Name	Known Species Occurrence on/near Federal Lands	Potential Habitat Present on/near Federal Lands	Known Species Occurrence on/near Non-federal Lands	Potential Habitat Present on/near Non-federal Lands	
Non-vascular Plants						
<i>Arctoparmelia centrifuga</i>	Arctoparmelia Lichen	No	No	No	No	Sunny rocks and open talus slopes.
<i>Arctoparmelia subcentrifuga</i>	Arctoparmelia Lichen	No	No	No	No	Sunny rocks and open talus slopes.
<i>Caloplaca parvula</i>	Unnamed Lichen	No	No	No	Yes	Smooth bark of young black ash in moist, humid old-growth black ash stands.
<i>Cetraria</i> (=Ahtiana) <i>aurescens</i>	Unnamed Lichen	No	Yes	No	Yes	Conifer bark in lowland conifer swamps (old cedar/black spruce).
<i>Cladonia wainioi</i>	Wain’s Cup Lichen	No	No	No	No	On rock outcrops and thin soil and exposed sites with lots of light.
<i>Frullania selwyniana</i>	Selwyn’s Scalewort	No	Yes	No	Yes	Lowland cedar swamps on bark of northern white cedar.
<i>Menegazzia terebrata</i>	Honeycombed Lichen	No	Yes	No	Yes	Cedar swamps, especially old growth, often at base of cedar trees.
<i>Peltigera venosa</i>	Fan Lichen	No	Yes	No	Yes	Soil and moist cliffs and on exposed root wads.
<i>Pseudocyphellaria crocata</i>	Yellow Specklebelly	No	Yes	No	Yes	Mossy rocks and trees in partially shaded, moist, frequently foggy habitats.
<i>Ramalina thrausta</i>	Cartilage Lichen	No	Yes	No	Yes	Cedar swamps, and especially old growth forest.
<i>Sticta fuliginosa</i>	Peppered Moon Lichen	No	Yes	No	Yes	On hardwoods in humid, old growth cedar or ash bogs.
<i>Usnea longissima</i>	Beard Lichen	No	Yes	No	Yes	On old conifers in moist situations, often in or near a conifer or hardwood swamps.

Table 1 (Cont.)
Regional Forester Sensitive Species Occurrence and Habitat Availability on the Federal and Non-Federal Lands

RFSS Species		Species and Habitat Occurrence				Habitat Characteristics
Scientific Name	Common Name	Known Species Occurrence on/near Federal Lands	Potential Habitat Present on/near Federal Lands	Known Species Occurrence on/near Non-federal Lands	Potential Habitat Present on/near Non-federal Lands	
Vascular Plants						
<i>Adoxa moschatellina</i>	Moschatel	No	No	No	Yes	Shaded damp cliffs and slopes in upland mature northern hardwood forests on North Shore of Lake Superior.
<i>Arnica lonchophylla</i>	Long-leaved Arnica	No	No	No	No	Cool and moist cliffs and ledges along North Shore of Lake Superior.
<i>Asplenium trichomanes</i>	Maidenhair Spleenwort	No	No	No	Yes	In crevices of moist, mostly east-facing cliffs, ledges, and talus; Rove formation.
<i>Astragalus alpinus</i>	Alpine Milkvetch	No	No	No	No	Found on rocky, gravelly margins of shallow groundwater-fed ponds; herbaceous cover is typically sparse.
<i>Bidens discoidea</i>	Small Beggarticks	No	Yes	No	Yes	Wet habitats. Silty shores and hummocks in floating mats and swamps; also partly submerged logs.
<i>Botrychium lanceolatum</i>	Triangle Grapefern	No	Yes	Yes	Yes	Northern hardwood forest, old fields, old logging roads, and trails.
<i>Botrychium lanceolatum</i> var. <i>angustisegmentum</i>	Lanceleaf Grapefern	No	Yes	No	Yes	Prefers moist, shady, mature northern hardwood forests, particularly in low areas.

Table 1 (Cont.)

Regional Forester Sensitive Species Occurrence and Habitat Availability on the Federal and Non-Federal Lands

RFSS Species		Species and Habitat Occurrence				Habitat Characteristics
Scientific Name	Common Name	Known Species Occurrence on/near Federal Lands	Potential Habitat Present on/near Federal Lands	Known Species Occurrence on/near Non-federal Lands	Potential Habitat Present on/near Non-federal Lands	
<i>Botrychium lunaria</i>	Common Moonwort	No	Yes	No	Yes	Prefers open habitats such as gravelly banks, rocky ledges, and talus. It has also been found in open, sparsely vegetated habitats with grasses and scattered shrubs, and open habitats such as old log landings, sawmill sites, and building sites.
<i>Botrychium michiganense</i> (<i>hesperium</i>)	Michigan Moonwort	Yes	Yes	No	Yes	Open habitats such as old log landings, old dirt roads, gravel pits, powerline corridors, borrow pits, beach ridges, old fields, trails, and dredge spoil dumps.
<i>Botrychium mormo</i>	Little Goblin Moonwort	No	No	No	No	Occurs in mature mesic hardwood forests where the dominant trees are sugar maple with lesser amounts of northern white cedar; canopy must be intact to maintain shaded and moist conditions.
<i>Botrychium pallidum</i>	Pale Moonwort	Yes	Yes	No	Yes	Full to shady exposure and edge of alder thickets.
<i>Botrychium rugulosum</i>	Ternate (St. Lawrence) Grapefern	Yes	Yes	No	Yes	Disturbed habitats, fields, open woods, and forests.
<i>Botrychium simplex</i>	Least Moonwort	Yes	Yes	No	Yes	Full to shady exposure at edge of alder thickets and along forest roads.
<i>Caltha natans</i>	Floating Marsh Marigold	Yes	Yes	No	Yes	Shallow water in ditches and streams, alder swamps, shallow marshes, and beaver ponds

Table 1 (Cont.)
Regional Forester Sensitive Species Occurrence and Habitat Availability on the Federal and Non-Federal Lands

RFSS Species		Species and Habitat Occurrence				Habitat Characteristics
Scientific Name	Common Name	Known Species Occurrence on/near Federal Lands	Potential Habitat Present on/near Federal Lands	Known Species Occurrence on/near Non-federal Lands	Potential Habitat Present on/near Non-federal Lands	
<i>Calypso bulbosa</i>	Fairy Slipper	No	Yes	No	Yes	Hummocks in northern white cedar swamps, moist to wet lowland coniferous swamps, and to lesser extent in upland coniferous forests.
<i>Carex novae-angliae</i>	New England Sedge	No	Yes	No	Yes	Moist woods with sugar maple, also with yellow birch, trembling aspen, white spruce dominated forest, and tall shrubs.
<i>Carex rossii</i>	Short Sedge	No	No	No	No	Rocky summits, dry exposed cliff faces, and rocky slopes, in east Border Lakes subsection.
<i>Crataegus douglasii</i>	Douglas' Hawthorn	No	No	No	No	North Shore of Lake Superior rocky and gravelly streambeds/banks and open areas, and rocky borders of woods.
<i>Cypripedium arietinum</i>	Ram's head Lady Slipper	No	Yes	No	Yes	Wide variety of forests, both upland and lowland, but in Minnesota predominantly in northern white cedar swamps; also in forests dominated by jack pine, red pine, or white pine.
<i>Drosera linearis</i>	Linear-leaved Sundew	No	Yes	No	Yes	One of a small group of rare plant species that are restricted to high-quality, undisturbed examples of a peatland type called patterned fens.
<i>Eleocharis nitida</i>	Quill Spikerush	Yes	Yes	No	Yes	Full exposure and moist ditches.
<i>Huperzia appalachiana</i>	Appalachian Clubmoss	No	No	No	Yes	Shelves and crevices on cliff/talus/rock outcrops, and shrub-dominated talus piles.

Table 1 (Cont.)

Regional Forester Sensitive Species Occurrence and Habitat Availability on the Federal and Non-Federal Lands

RFSS Species		Species and Habitat Occurrence				Habitat Characteristics
Scientific Name	Common Name	Known Species Occurrence on/near Federal Lands	Potential Habitat Present on/near Federal Lands	Known Species Occurrence on/near Non-federal Lands	Potential Habitat Present on/near Non-federal Lands	
<i>Juncus stygius</i>	Moor Rush	Yes	Yes	No	Yes	Open-patterned peatlands, rich and poor fens, and northern black spruce bogs.
<i>Juncus subtilis</i>	Creeping Rush	No	No	No	No	Sandy lakeshore; only known occurrence is in the Boundary Waters Canoe Area Wilderness (BWCAW).
<i>Listera auriculata</i>	Auricled Twayblade	No	Yes	No	Yes	On alluvial or lake-deposited sands or gravels, with occasional seasonal flooding; associated with riparian alder or black spruce/balsam fir forest.
<i>Littorella uniflora</i> (= <i>L. americana</i>)	American Shoreweed	No	Yes	No	Yes	Shallow margins of nutrient-poor lakes and seepage lakes; sandy substrates and may have fine gravel/organic soil; fluctuating water level up to about 3 feet.
<i>Moehringia macrophylla</i>	Largeleaf Sandwort	No	No	No	Yes	Cliffs/rock outcrops, talus, and conifer sites on shallow soils; pine plantation with rocky outcrops; usually semi-open shrub or tree canopy.
<i>Muhlenbergia uniflora</i>	Bog Muhly	No	Yes	No	Yes	Wet sandy beaches and floating peat mats.
<i>Nymphaea leibergii</i>	Leiberg's Water-lily	No	Yes	No	Yes	Slow moving streams, rivers, and beaver impoundments 3 to 6 feet deep; occurs at outer margin of emergent vegetation.
<i>Osmorhiza berteroi</i>	Chilean Sweet-cicely	No	No	No	No	Northern hardwood forest dominated by sugar maple on North Shore of Lake Superior.

Table 1 (Cont.)
Regional Forester Sensitive Species Occurrence and Habitat Availability on the Federal and Non-Federal Lands

RFSS Species		Species and Habitat Occurrence				Habitat Characteristics
Scientific Name	Common Name	Known Species Occurrence on/near Federal Lands	Potential Habitat Present on/near Federal Lands	Known Species Occurrence on/near Non-federal Lands	Potential Habitat Present on/near Non-federal Lands	
<i>Oxytropis borealis</i> var. <i>viscida</i>	Sticky Locoweed	No	No	No	Yes	Slate cliffs and talus slopes in east Border Lakes subsection; arctic/alpine disjunct.
<i>Piptatherum</i> (= <i>Oryzopsis</i>) <i>canadense</i>	Canada Ricegrass	No	Yes	No	Yes	Sandy/gravelly soil; red pine and jack pine plantations; borders, edges, trailsides, and openings.
<i>Polemonium occidentale</i> ssp. <i>lacustre</i>	Western Jacob's-ladder	No	Yes	No	Yes	Primarily northern white cedar swamps, but also mixed conifer swamps; thrives in openings.
<i>Polystichum braunii</i>	Braun's Holly Fern	No	No	No	Yes	Cool, shady cliffs and slopes in northern hardwoods in North Shore Highlands subsection.
<i>Potamogeton oakesianus</i>	Oakes' Pondweed	No	No	No	No	Quiet, acidic waters of bogs, ponds, and lakes.
<i>Prosartes trachycarpa</i> (synonym = <i>Disporum trachycarpum</i>)	Roughfruit Fairybells	No	No	No	Yes	Semi-open jack pine forest with trembling aspen, paper birch, and shallow rocky soils in east Border Lakes subsection.
<i>Pyrola minor</i>	Snowline Wintergreen	Yes	Yes	No	Yes	Black spruce swamps and ecotone between uplands and lowland speckled alder/coniferous swamp; prefers closed canopy.
<i>Rubus chamaemorus</i>	Cloudberry	No	Yes	No	Yes	Black spruce/sphagnum forest with acidic water; Superior National Forest at southern edge of species range.
<i>Saxifraga cernua</i>	Nodding Saxifrage	No	No	No	No	Cliffs, ledges, and diabase cliffs (calcium based feldspars); arctic/alpine disjunct.

Table 1 (Cont.)

Regional Forester Sensitive Species Occurrence and Habitat Availability on the Federal and Non-Federal Lands

RFSS Species		Species and Habitat Occurrence				Habitat Characteristics
Scientific Name	Common Name	Known Species Occurrence on/near Federal Lands	Potential Habitat Present on/near Federal Lands	Known Species Occurrence on/near Non-federal Lands	Potential Habitat Present on/near Non-federal Lands	
<i>Saxifraga paniculata</i>	Encrusted Saxifrage	No	No	Yes	Yes	Cliffs, sheltered crevices, and ledges of north-facing cliffs; arctic/alpine disjunct.
<i>Subularia aquatica</i>	American Waterawlwort	No	Yes	No	Yes	Beach zone of sandy nutrient-poor lakes and shallow lake margins; submerged, emerged, or stranded; water depth of 6 to 24 inches, but can occur in deeper water.
<i>Taxus canadensis</i>	Canada Yew	No	Yes	No	Yes	Wide variety of uplands and lowlands, including northern white cedar/black ash swamps, talus and cliffs, northern hardwoods, and trembling aspen/paper birch forest.
<i>Tofieldia pusilla</i>	Scotch False Asphodel	No	No	No	No	Sedge mats at edges of shoreline rock pools along Lake Superior; arctic disjunct.
<i>Viola lanceolata</i>	Bog White Violet	No	Yes	No	Yes	Sandy to peaty lakeshores; borders of marshes and bogs and damp sand ditches.
<i>Waldsteinia fragarioides</i>	Barren Strawberry	No	Yes	No	Yes	Upland coniferous and deciduous forests, in recently harvested areas, established plantations, and areas with no recent harvest.
<i>Woodsia glabella</i>	Smooth Woodsia	No	No	No	No	Moist, north-facing cliffs along Lake Superior; arctic disjunct.

Table 1 (Cont.)
Regional Forester Sensitive Species Occurrence and Habitat Availability on the Federal and Non-Federal Lands

RFSS Species		Species and Habitat Occurrence				Habitat Characteristics
Scientific Name	Common Name	Known Species Occurrence on/near Federal Lands	Potential Habitat Present on/near Federal Lands	Known Species Occurrence on/near Non-federal Lands	Potential Habitat Present on/near Non-federal Lands	
Invertebrates – Bivalves						
<i>Lasmigona compressa</i>	Creek Heelsplitter	No	Yes	No	Yes	Headwaters of larger rivers. St. Louis river and tributaries and Lake of the Woods tributaries.
<i>Ligumia recta</i>	Black Sandshell	No	Yes	No	Yes	Medium to large rivers.
Invertebrates - Insects						
<i>Chilostigma itascae</i>	Headwaters Chilostigman Caddisfly	No	Yes	No	Yes	Predominantly bogs, fens, and heaths.
<i>Erebia mancinus</i>	Taiga Alpine	No	Yes	No	Yes	Shady black spruce swamp.
<i>Plebejus idas nabokovi</i>	Nabokov’s Blue	No	Yes	No	Yes	Dwarf bilberry host in open sandy jack pine areas.
<i>Pyrgus centaureae freija</i>	Freija’s Grizzled Skipper	No	Yes	No	Yes	Upland acidic meadow.
<i>Somatochlora brevicincta</i>	Quebec Emerald Dragonfly	No	Yes	No	Yes	Predominantly bogs, fens, and heaths.
<i>Williamsonia fletcheri</i>	Ebony Boghaunter	No	Yes	No	Yes	Predominantly bogs, fens, and heaths.
Fish						
<i>Acipenser fulvescens</i>	Lake Sturgeon	No	No	No	No	Large lakes and rivers in the Hudson Bay drainage of Superior National Forest.
<i>Coregonus nipigon</i>	Nipigon Cisco	No	No	No	No	Known distribution restricted to Saganaga Lake in northeastern Minnesota and southern Ontario.
<i>Coregonus zenithicus</i>	Shortjaw Cisco	No	No	No	No	Lake Superior, Saganaga, and Gunflint Lakes, possibly others.

Table 1 (Cont.)

Regional Forester Sensitive Species Occurrence and Habitat Availability on the Federal and Non-Federal Lands

RFSS Species		Species and Habitat Occurrence				Habitat Characteristics
Scientific Name	Common Name	Known Species Occurrence on/near Federal Lands	Potential Habitat Present on/near Federal Lands	Known Species Occurrence on/near Non-federal Lands	Potential Habitat Present on/near Non-federal Lands	
<i>Ichthyomyzon fossor</i>	Northern Brook Lamprey	No	Yes	No	Yes	Warm, medium-sized, low-gradient streams with sections of higher gradient reaches suitable for spawning; requires organically enriched and sandy substrate until metamorphosis.
Reptiles						
<i>Glyptemys insculpta</i>	Wood Turtle	No	Yes	No	Yes	Upland and lowland habitats with suitable shade and insects for forage; riparian habitats with open sandy areas for nesting.
Birds						
<i>Accipiter gentilis</i>	Northern Goshawk	Yes	Yes	Yes	Yes	Large patch of older trees with closed canopy and open understory.
<i>Aegolius funereus</i>	Boreal Owl	Yes	Yes	No	Yes	Secondary cavity nester; old boreal forest (including trembling aspen) next to lowland conifer foraging areas.
<i>Contopus cooperi</i>	Olive-sided Flycatcher	No	Yes	No	Yes	Snags, low density conifer lowlands, and riverine/riparian areas.
<i>Dendroica castanea</i>	Bay-breasted Warbler	No	Yes	No	Yes	Mature upland and lowland black spruce and balsam fir forests.
<i>Haliaeetus leucocephalus</i>	Bald Eagle	Yes	Yes	No	Yes	Large lakes and rivers with large trees for nesting and roosting.
<i>Oporornis agilis</i>	Connecticut Warbler	No	Yes	No	Yes	Jack pine or lowland conifer with a thick ericaceous understory.
<i>Picoides tridactylus</i>	Three-toed Woodpecker	Yes	Yes	No	Yes	Coniferous forests with snags.

Table 1 (Cont.)
Regional Forester Sensitive Species Occurrence and Habitat Availability on the Federal and Non-Federal Lands

RFSS Species		Species and Habitat Occurrence				Habitat Characteristics
Scientific Name	Common Name	Known Species Occurrence on/near Federal Lands	Potential Habitat Present on/near Federal Lands	Known Species Occurrence on/near Non-federal Lands	Potential Habitat Present on/near Non-federal Lands	
<i>Strix nebulosa</i>	Great Gray Owl	Yes	Yes	No	Yes	Nesting habitat of mature trees on wet soil with greater than 60% canopy cover near open foraging areas.
Mammals						
<i>Canis lupus</i>	Gray Wolf	Yes	Yes	Yes	Yes	Variety of open and wooded habitats.
<i>Myotis lucifugus</i>	Little Brown Myotis	Yes	Yes	Potential	Yes	Forest habitats and buildings, attics, and other man-made structures.
<i>Myotis septentrionalis</i>	Northern long-eared Bat	Yes	Yes	Potential	Yes	Found in most caves and mines surveyed in Minnesota, although typically in low numbers.
<i>Perimyotis subflavus</i>	Tri-colored Bat	No	Yes	Potential	Yes`	Hibernate in caves, mines, and tunnels during winter, roost in trees during summer. Maternity colonies found in trees, rock crevices, and barns or other buildings.
<i>Phenacomys ungava</i>	Eastern Heather Vole	No	Yes	No	Yes	Forest, brushland, or clearcuts with bilberry and rocks.

2.0 Description of the Proposed Action and Alternatives

2.1 Proposed Action (Alternative A)

2.1.1 Overview

The USACE and the USFS have separate proposed actions on which consultation is occurring. The USACE has an application under the Clean Water Act to impact wetlands and other waters of the U.S. associated with the construction and operation of the NorthMet mine. The USFS is evaluating a land exchange of federal and non-federal lands. For convenience, the impacts are described in terms of the Project and its associated activities.

PolyMet proposes to construct an open pit mine in northern Minnesota to extract low- to medium-quality copper-nickel-PGE minerals with low sulfide content. This Project is located in Sections 5, 6, 8, 9, 13, 14, 15, 16, 17, 23, and 24, Township 58 North, Range 14 West; Sections 1, 2, 3, 4, 9, 10, 11, 12, 15, 16, 17, and 18, Township 59 North, Range 13 West; Sections 3, 4, 5, 8, 9, 10, 11, 13, 14, 15, 16, 17, 20, 23, 24, 29, and 32, Township 59 North, Range 14 West; and Sections 32, 33, and 34, Township 60 North, Range 14 West, in St. Louis County on the eastern end of the Mesabi Iron Range, about 60 miles north of the City of Duluth, and 6 miles south of the City of Babbitt, Minnesota (**Figure 1**).

This section describes specific Project features that could have potential effects on RFSS and their habitats. Additional Project features that are not relevant to potential effects on RFSS and their habitats are listed in this section, but are not described in detail. Full Project details are available in the FEIS (MDNR et. al. 2015).

Ore would be excavated at the Mine Site and hauled by railroad approximately 8 miles west to the Plant Site for processing. Corridors for roads, railroad, utilities, and water pipelines would connect the Mine Site and the Plant Site. The four Project areas are shown on **Figure 1** and include:

- Mine Site
- Plant Site
- Dunka Road and Utility Corridor
- Railroad Connection Corridor

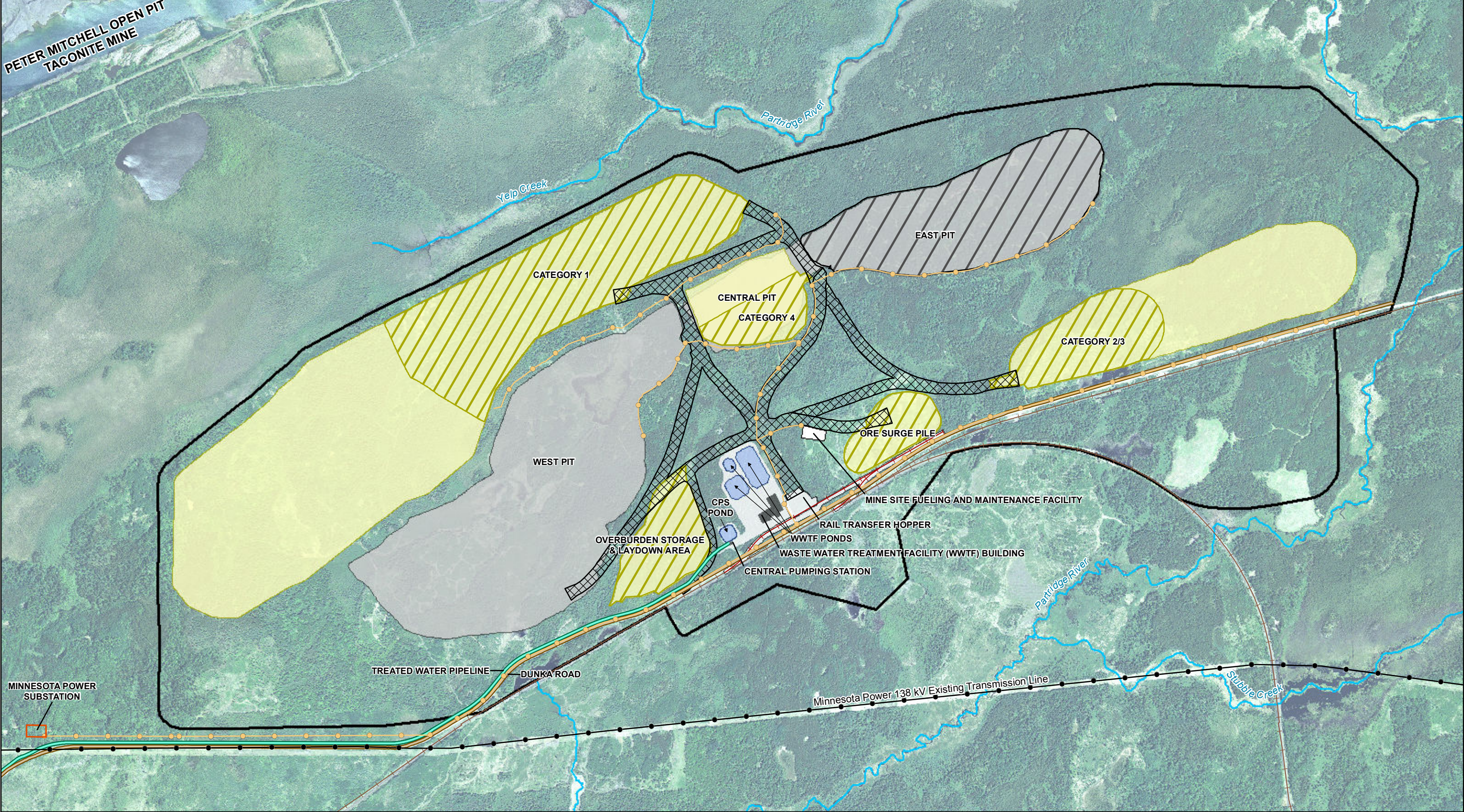
2.1.2 Mine Site

The Mine Site, approximately 3,015 acres, would be developed at a greenfield site that has previous disturbance from logging and mining exploration activities. The Project would develop open mine pits (up to 528 acres), stockpiles (up to 794 acres), and supporting infrastructure (up to 397 acres). The location and dimensions of Mine Site features are shown on **Figure 4**. The Project features at the Mine Site would include:

- mine pits;
- ore storage and handling facilities, including an Ore Surge Pile and a Rail Transfer Hopper;

DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

- stockpiles for overburden and waste rock with engineered systems to manage potential water resource impacts (such as liners, covers, and the Category 1 Waste Rock Stockpile Groundwater Containment System);



Mine Site	Haul Roads
Year 1 Mine Pits	Treated Water Pipeline
Year 11 Mine Pits	Dunka Road
Year 1 Stockpiles	Existing Private Railroad
Year 11 Stockpiles	Proposed Railroad Track

Figure 4
Mine Site Plan
Biological Evaluation for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

- a Waste Water Treatment Facility and process water collection systems to collect and treat water from the mine pits, waste rock stockpiles, ore handling facilities, and haul roads;
- a Central Pumping Station and Treated Water Pipeline to transport water from the Mine Site to the Plant Site; and
- supporting infrastructure (such as roads, electrical supply, rail connections, and fueling and maintenance facilities).

2.1.2.1 Pre-production Mine Development

Mine Site infrastructure would be constructed during the estimated 12 to 18 months of pre-production mine development. Pre-production mine development would be followed by a gradual ramp-up of ore output over 6 to 12 months. The following Project features would be constructed during pre-production mine development:

- Roads - site access roads, haul roads, and Dunka Road upgrades.
- Railroad infrastructure - the Rail Transfer Hopper, the rail spur connecting the Rail Transfer Hopper with Cliffs Erie railroad track, and the rail spur between the Cliffs Erie railroad track and PolyMet railroad track that serves the Coarse Crusher Building.
- Surface water management features - dikes ditches, water collection ponds, and sumps.
- Overburden Storage and Laydown Area.
- Stockpile liners and containment systems.
- Waste Water Treatment Facility, Treated Water Pipeline, and Central Pumping Station.
- Substation drop from the 138 kilovolt (kV) Minnesota Power transmission line and a 13.8 kV Mine Site power distribution system.
- Mine Site Fueling and Maintenance Facility.

2.1.2.2 Mining Activities

PolyMet expects to mine a total of 533 million tons of waste rock and ore over 20 years, which would include 225 million tons of ore and 308 million tons of waste rock. Mining activities include overburden removal, open pit mining, drilling and blasting, excavation and haulage, ore storage and loading for transport to the Process Plant, waste rock stockpiling, and mine site water management.

Overburden Removal

The marketable timber would be cleared and the overburden removed from the footprints of the mine pits, the Ore Surge Pile, and the waste rock stockpiles, as necessary. Overburden has been defined for this Project as the material that lies on top of the underlying bedrock.

Overburden would be stripped incrementally as needed for mine development in order to minimize the amount of bedrock exposed at any one time. After removal of overburden from the initial mining area, additional overburden stripping could take place concurrently with the mining of ore and waste rock. Approximately 32% of the required overburden stripping for the pit development would be done in the first 2 years of mine operation. All of the overburden that needs to be stripped from the pits would be removed by the end of Mine Year 11.

Open Pit Mining

The Project would use open pit mining methods similar to those used at ferrous metallic mining operations on the Iron Range. The mine would consist of three separate open pits known as the East, Central, and West pits. For approximately the first 10 years of operations, mining would take place in the East and West pits simultaneously, with the East Pit mining ending in Mine Year 11. The Central Pit mining would occur between Mine Years 11 and 16. During Central Pit mining, the East and Central pits would converge into one pit which would then be referred to as the East Pit.

At its maximum size, each pit is projected to have the approximate maximum area and depth shown in **Table 2**.

Table 2
Maximum Pit Dimensions

Mine Pit	Area (acres)	Maximum Depth (feet below ground surface)
East	155	696
Central	52	356
West	321	630

Drilling and blasting would be conducted to remove waste rock and extract ore. Two conventional electric or diesel powered rotary drilling rigs would be used. Blasting of ore and waste rock is anticipated to take place approximately every 2 to 3 days.

After being drilled and blasted, the ore would be loaded by excavators into haul trucks that would haul the ore to the Rail Transfer Hopper or to the Ore Surge Pile for temporary storage, and haul the waste rock to the stockpiles or the East Pit. Up to nine haul trucks would be in service with a maximum speed of 34 miles per hour loaded, however their speed would typically be lower.

Mining operations would be supported by mine auxiliary vehicles (in other words [e.g.], water trucks, dozers, graders) traveling on access and haul roads within the Mine Site.

Ore Storage and Loading

Ore would be loaded for transport to the Plant Site at the Rail Transfer Hopper. The Rail Transfer Hopper would consist of a raised platform from which haul trucks dump into a hopper over a pan feeder into rail cars. The Rail Transfer Hopper would be located to the south of the mine pits and would be connected to the existing Cliffs Erie main line track by a new spur line (**Figure 4**).

An Ore Surge Pile would be constructed adjacent to the Rail Transfer Hopper to allow for temporary storage of ore until it could fit into the processing schedule or as required by operational delays. Drainage from the Ore

DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

Surge Pile would be collected on a liner and routed to a sump for pumping to the Waste Water Treatment Facility.

Stockpiling

Waste rock and overburden would be managed according to its geochemical properties as determined using a sampling and analysis program approved by the MDNR. PolyMet has categorized waste rock into four categories defined according to its sulfur content, in ascending order of reactivity. These waste rock categories are summarized in **Table 3**.

The Category 1 Waste Rock Stockpile would be the only permanent stockpile for the Project. During Mine Years 1 through 11, Category 2, 3 and 4 waste rock would be placed on the temporary Category 2/3 or Category 4 Waste Rock Stockpiles (**Figure 4**). When at its maximum size, each stockpile is projected to have the approximate area, height, and elevation shown in **Table 4**.

Table 3
Waste Rock Properties

Waste Rock Categorization	Sulfur Content (percent)¹	Approximate Percent of Total Waste Rock Produced during Mining (percent)
Category 1	≤ 0.12	70
Category 2	> 0.12 to ≤ 0.31	24
Category 3	> 0.31 to ≤ 0.60	3
Category 4	> 0.6	3

¹In general, the higher the rock's sulfur content, the higher it's potential for generating acid rock drainage or leaching heavy metals.

Table 4
Maximum Stockpile Dimensions - Approximate

Stockpile	Mine Year of Maximum Footprint	Maximum Footprint (acres)	Maximum Height (feet)	Maximum Elevation (feet above sea level)
Category 1 waste rock	6/21 ¹	508/526 ¹	280	1,880
Category 2/3 waste rock	6	180	200	1,770
Category 4 waste rock	3	57	180	1,790
Ore Surge Pile	NA ²	31	120	1,690

¹The Category 1 Waste Rock Stockpile has a maximum footprint of 508 acres while active. It would reach this size by Mine Year 6. The stockpile would be re-graded as part of the reclamation with a final footprint of 526 acres.

²The Ore Surge Pile would have ore moving in and out as needed to meet mine and plant operations.

All waste rock stockpiles would be engineered to manage water resource impacts. The temporary Category 2/3 and Category 4 Waste Rock Stockpiles, which have the potential to generate acid rock drainage, would have liner systems to capture water passing through the stockpile. The permanent Category 1 Waste Rock Stockpile, which does not have the potential to generate acid rock drainage, would be constructed with a groundwater containment system to collect stockpile drainage from around the entire stockpile.

Progressive Reclamation

Reclamation of the East Pit and the temporary waste rock stockpiles would begin during operations. The temporary Category 2/3 and Category 4 Waste Rock Stockpiles would be relocated to the East Pit starting in Mine Year 11. The infrastructure associated with the temporary stockpiles (pipes, pumps, liners, etc.) would be removed and the footprint of each area would be reclaimed.

After the temporary stockpiles are reclaimed, all future Category 2, 3, and 4 waste rock would be placed in the East Pit. Most of the Category 1 waste rock mined after Mine Year 12 would also be placed in the East Pit. Ultimately, approximately 45% of the total waste rock mined would be backfilled to the East Pit.

The East Pit would be flooded to keep the waste rock in a subaqueous environment to reduce the environmental impact associated with further oxidation and dissolution of sulfide minerals. If natural inflow of water into the East Pit is insufficient to keep the waste rock submerged, water could be pumped from the Waste Water Treatment Facility. During periods of high precipitation or during spring snowmelt, dewatering (to the Waste Water Treatment Facility and ultimately to the Flotation Tailings Basin) may be required to allow safe placement of the waste rock.

Reclamation of the Category 1 Waste Rock Stockpile would also begin during operations. A cover system would be added incrementally after Mine Year 13 to limit infiltration through the stockpile. The stockpile would be sloped and graded, an engineered geomembrane system would be installed, soil would be placed on top of the cover, and vegetation would be planted to meet the requirements of Minnesota Rules, part 6132.2200, subpart 2, item B. The cover system would be designed to promote runoff with minimal erosion.

Mine Site Water Management

This section summarizes information from the Water Management Plan - Mine, which would become part of the MDNR Permit to Mine and Water Appropriations permits and Minnesota Pollution Control Agency (MPCA) National Pollutant Discharge Elimination System/State Disposal System permit. These plans include water management system designs, operating and maintenance plans, water quality monitoring plans, reporting requirements, and adaptive management approach.

In addition to the stockpile liners, the stockpile cover, and the groundwater containment system, water management at the Mine Site would include pit dewatering, stormwater dikes and ditches, and the Waste Water Treatment Facility that would treat water that comes in contact with mining features. During operations, there would be no direct discharge of treated waste water to public waters.

It would be necessary to dewater the pits during mining to remove groundwater flow and precipitation runoff. These waters would be directed to low areas in the pits where it would be collected in sumps and pumped to the Waste Water Treatment Facility.

Non-contact stormwater, the result of precipitation that falls on natural or reclaimed vegetated surfaces, would be routed through sedimentation ponds prior to discharge to a small watercourse that flows to the Partridge River. A system of dikes and ditches constructed at the Mine Site perimeter would minimize the amount of surface water flowing onto the site and into the mine pits, manage the amount of water that comes into contact with mining features, and control non-contact stormwater flowing off the site.

During operations, the Waste Water Treatment Facility would treat water that comes into contact with the waste rock stockpiles, haul roads, Ore Surge Pile, and mine pits. For the first approximately 10 years, all Waste Water Treatment Facility effluent would be pumped to the Plant Site Flotation Tailings Basin Pond for reuse in the beneficiation process. Reuse of the Mine Site process water at the Plant Site would eliminate the need to discharge any process water to surface waters during operations. Starting in Mine Year 11, some Waste Water Treatment Facility effluent would be sent to the East Pit to augment flooding as the pit is backfilled, with the remainder of the effluent continuing to go to the Flotation Tailings Basin. The purpose of the Waste Water Treatment Facility is to maintain water quality in the Flotation Tailings Basin pond at concentrations that do not have an adverse impact on Beneficiation Plant operations or future reclamation of the Flotation Tailings Basin.

Mine Site water would be managed in accordance with a future MPCA National Pollutant Discharge Elimination System/State Disposal System permit, which would include a Stormwater Pollution Prevention Plan. The Stormwater Pollution Prevention Plan would identify and describe Best Management Practices for the Mine Site to minimize the discharge of potential pollutants in stormwater runoff.

2.1.2.3 Fueling and Maintenance Facilities

The Mine Site Fueling and Maintenance Facility would consist of two buildings, one for fueling mobile equipment, and one for minor service and repair of mobile equipment. Major scheduled maintenance and repair work lasting several days on most mobile equipment would be done in the refurbished and reactivated former LTVSMC Area 1 Shop. Stationary or slow-moving equipment such as excavators, dozers, drill rigs, and light plants would be fueled in the field using mobile fuel tankers.

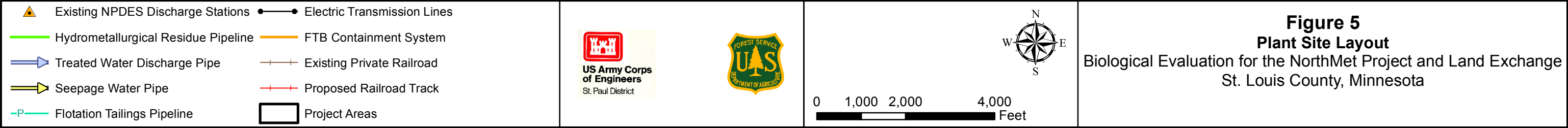
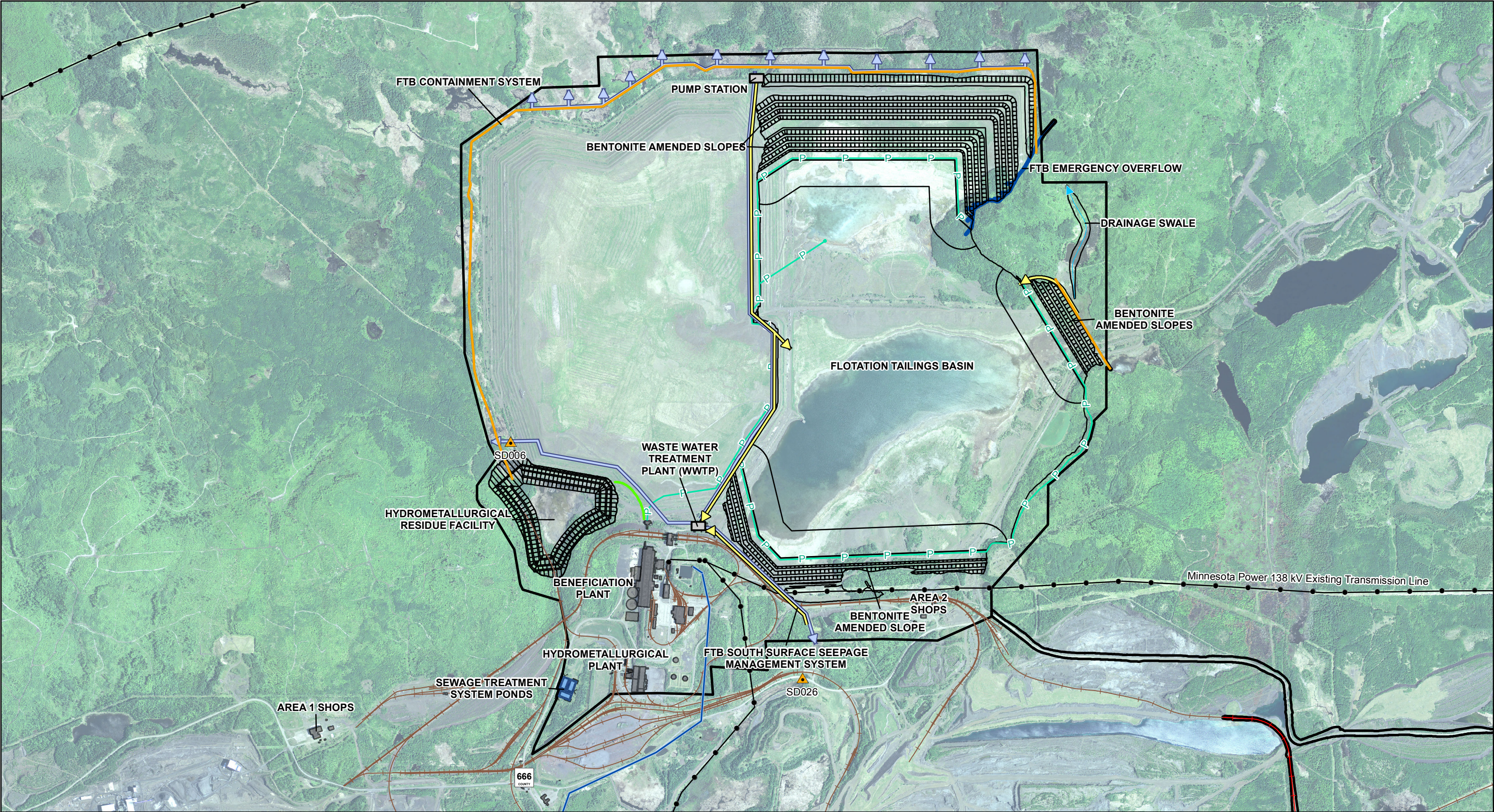
The former LTVSMC Area 2 Shop, about 1 mile east of the Process Plant, would be reactivated to provide office space for mining and railroad operations supervision and management, as well as clothes changing facilities, toilets, lunch rooms, first aid facility, emergency response center, and training and meeting rooms for mining and railroad crews. The Area 2 Shop facilities would include a Locomotive Fueling Station, Locomotive Service Building, and Mine Reporting Building.

2.1.3 Plant Site

The Plant Site was previously used as a taconite processing facility by the LTVSMC. The location and dimensions of Plant Site features are shown on **Figure 5**.

At the Plant Site, the Project would upgrade existing facilities (Beneficiation Plant, Tailings Basin, Area 1 Shop, sewage collection system, rail connections, access roads) and construct new facilities (Hydrometallurgical Plant, Hydrometallurgical Residue Facility, Concentrate Dewatering/Storage Building, Sewage Treatment System Ponds, and Waste Water Treatment Plant) within an existing brownfield facility. The Flotation Tailings would be stored atop the existing LTVSMC Tailings Basin by staged construction of new dams. The Plant Site also includes supporting infrastructure (e.g., roads, electrical supply, rail connections, Area 1 Shop, and Area 2 Shop).

Plant Site environmental controls would include: cover systems to limit infiltration of oxygen and water through the Flotation Tailings Basin dams, beaches, and pond bottom, and seepage capture systems to collect seepage from the Flotation Tailings Basin. Most water used in processing would be recycled for use. A Waste Water Treatment Plant would be constructed, including reverse osmosis or similar membrane separation technology, to treat any water that could not be recycled prior to discharge to the environment. If makeup water is needed for



processing, it may be provided via the Colby Lake Water Pipeline. No new construction is required for the Colby Lake Water Pipeline.

2.1.3.1 Ore Processing

A Beneficiation Plant and Hydrometallurgical Plant would process the ore at the Plant Site to recover base metals, gold, and platinum group metals. The purpose of the beneficiation process would be to produce final separate concentrates. One of the separate concentrates would be a copper concentrate. The other separate concentrates would be differing grades of nickel concentrate. The concentrates could be shipped to customers, used as a feedstock to the hydrometallurgical process, or divided for both uses. PolyMet expects that the Beneficiation Plant would be operational several years before the Hydrometallurgical Plant and during that period all concentrates would be shipped to customers. Once the Hydrometallurgical Plant becomes operational, some or all of the nickel concentrates would be feedstock to the hydrometallurgical process. The decision to ship or process concentrates would be based on equipment maintenance schedules, customer requirements, and overall Project economics.

Beneficiation Plant

The Beneficiation Plant processes would include ore crushing, grinding, flotation, dewatering, storage, and shipping. Crushing and grinding would occur in the existing Coarse Crusher Building, Fine Crusher Building, and Concentrator Building. Flotation would occur in a new Flotation Building located on previously disturbed ground immediately to the west of the Concentrator Building. Dewatering, storage, and shipping would occur in a new Concentrate Dewatering/Storage Building located on previously disturbed ground.

Hydrometallurgical Plant

Hydrometallurgical processing technology would be used for the treatment of nickel concentrates. This process would involve high pressure and temperature autoclave leaching followed by solution purification steps to extract and isolate platinum group metals, precious metals, and base metals. All equipment used in the hydrometallurgical process would be located in a new Hydrometallurgical Plant Building. Should spillage of process fluids occur, it would remain within the Hydrometallurgical Plant Building and be returned to the appropriate process streams.

Plant Site Infrastructure

Plant Site infrastructure that exists at this site includes:

- County Road 666 ends at the Main Gate for the industrial area that includes the Process Plant, Area 1 Shop, and Area 2 Shop.
- The Canadian National Railroad serves the industrial area that would include the Process Plant. The PolyMet railroad would connect to the Area 1 Shop and the Area 2 Shop.
- Three Minnesota Power Company 138 kV transmission lines serve the Project substation.

- The existing mechanical Sewage Treatment Plant would be replaced with new Sewage Treatment System Ponds, and the existing sewage collection system would be upgraded to meet current construction and performance standards and sized as appropriate.
- The Process Plant potable water treatment plant located near the Plant Reservoir would be refurbished and reactivated. The potable water distribution system extends to the Area 1 Shop and Area 2 Shop. This water would be used for showers and sinks and would be treated (chlorinated) to be drinkable. However, bottled water would be brought in for drinking as well.
- Area 1 Shop and Area 2 Shop.

2.1.3.2 Flotation Tailings Basin

Flotation Tailings from the flotation process at the Beneficiation Plant would be pumped to the Flotation Tailings Basin, which would be constructed on top of cells 1E and 2E of the existing LTVSMC Tailings Basin. Treated water from the Waste Water Treatment Facility would also be pumped to the Flotation Tailings Basin, enabling it to serve as the primary collection and distribution point for water used in the beneficiation process.

The existing LTVSMC Tailings Basin is unlined and was constructed in stages beginning in the 1950s. It has been inactive since January 2001, except for reclamation activities consistent with a MDNR-approved Closure Plan currently managed by Cliffs Erie.

The future Flotation Tailings Basin perimeter dams would be raised using upstream construction methods. The dams would be constructed using compacted LTVSMC tailings borrowed from the existing Tailings Basin. Once the LTVSMC tailings supply has been completely used for dam construction, offsite borrow from MDNR-approved sources would be utilized. Material from LTVSMC Area 5 would be a likely source, but other sources could also be considered.

Emergency overflow channels would be provided to protect the dams in the unlikely event that freeboard within the Flotation Tailings Basin is not sufficient to contain all water from an extreme storm event. Even though there is a low likelihood of overflow, it is standard practice in dam design to accommodate overflows in a manner that protects the integrity of the dams.

Seepage from the Flotation Tailings Basin would be collected by the Flotation Tailings Basin Containment System located around the northern, western, and portions of the eastern sides of the Tailings Basin and the Flotation Tailings Basin South Surface Seepage Management System located south of Tailings Basin Cell 1E. These two systems are collectively referred to as the Flotation Tailings Basin Seepage Capture Systems. The Flotation Tailings Basin Containment System would include a low permeability cutoff wall so that it can collect seepage (from up-gradient), but avoid drawing in water from down-gradient wetlands.

2.1.3.3 Hydrometallurgical Residue Facility

The Hydrometallurgical Residue Facility would be constructed to manage residues generated by the hydrometallurgical process. The Hydrometallurgical Residue Facility would consist of a one-lined cell located adjacent to the southwest corner of Tailings Basin, on previously disturbed ground (**Figure 5**).

DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

The Hydrometallurgical Residue Facility liner system would be a double liner system consisting of two barrier layers separated by a leakage collection layer. This system would substantially remove all hydraulic head from the lower liner, virtually eliminating leakage from the Hydrometallurgical Residue Facility.

Residue from the Hydrometallurgical Plant would be pumped to the Hydrometallurgical Residue Facility as slurry. A pond would be maintained within the Hydrometallurgical Residue Facility so that the solids in the slurry would settle out. Most of the liquid would be recovered by a pump system and returned to the plant for reuse.

2.1.3.4 Plant Site Water Management

This section summarizes information from the Water Management Plan - Plant, which is a support document for the MDNR Permit to Mine and Water Appropriations permits and MPCA National Pollutant Discharge Elimination System/State Disposal System permit. These plans include water management system designs, operating and maintenance plans, preliminary water quality monitoring plans, preliminary reporting requirements, and adaptive management approach. Final water quality monitoring and reporting requirements would be determined in the permits.

Water management features at the Plant Site would include the Flotation Tailings Basin and seepage capture systems, Hydrometallurgical Residue Facility, stormwater dikes and ditches, drainage swale, Waste Water Treatment Plant, and stream augmentation. With the exception of the Flotation Tailings Basin seepage containment system, all Plant Site water management features would be located on previously disturbed areas.

Waste Water Treatment Plant

The Waste Water Treatment Plant would treat any water collected by the Flotation Tailings Basin seepage capture systems that cannot be reused as process water. It would include a reverse osmosis unit or similar membrane separation technology designed to achieve an effluent sulfate concentration that meets the sulfate standard for waters used for the production of wild rice (10 milligrams per liter (mg/L)). Water would be treated to meet appropriate discharge limits, then discharged along the west, northwest, and north perimeter of the Flotation Tailings Basin, beyond the Flotation Tailings Basin Containment System, and to Second Creek at the south end of the Flotation Tailings Basin to replenish the flow to the surrounding wetlands and streams. This discharge strategy would limit the potential for indirect wetland impacts due to reduced seepage from the Tailings Basin to the wetlands.

Stream Augmentation

Construction of the Flotation Tailings Basin Containment System would reduce the amount of seepage that is currently leaving the existing Tailings Basin. Consequently, the stream flow in the four tributaries around the Tailings Basin (Unnamed Creek, Second Creek, Trimble Creek, and Mud Lake Creek) would be reduced from current levels. Flow to Unnamed Creek, Second Creek, and Trimble Creek would be augmented by treated water from the Waste Water Treatment Plant. Flow to Mud Lake Creek would be augmented by construction of a drainage swale east of the Flotation Tailings Basin.

2.1.4 Transportation and Utility Corridors

The remaining Project components are linear corridor features, including the following:

- Dunka Road and Utility Corridor
- Railroad Connection Corridor
-

This section describes Project features in the Transportation and Utility Corridors and presents information on the types of traffic that would result from the Project.

2.1.4.1 Dunka Road and Utility Corridor

Dunka Road is an existing, compacted-gravel, private road that extends from near the LTVSMC Plant Site to the Mine Site, then continues roughly northeast toward Babbitt, Minnesota (**Figure 6**). The portion of Dunka Road that connects the Plant Site to the Mine Site would be widened. The Treated Water Pipeline would be constructed parallel and adjacent to the Dunka Road in the Utility Corridor to transport treated water from the Mine Site to the Plant Site. The distance along Dunka Road from the Plant Site gate to the Mine Site gate is approximately 6.4 miles. Including the road segments located within the Plant Site and the Mine Site, the total distance from the ore processing area at the Plant Site to the ore loading area at the Mine Site is approximately 8.5 miles.

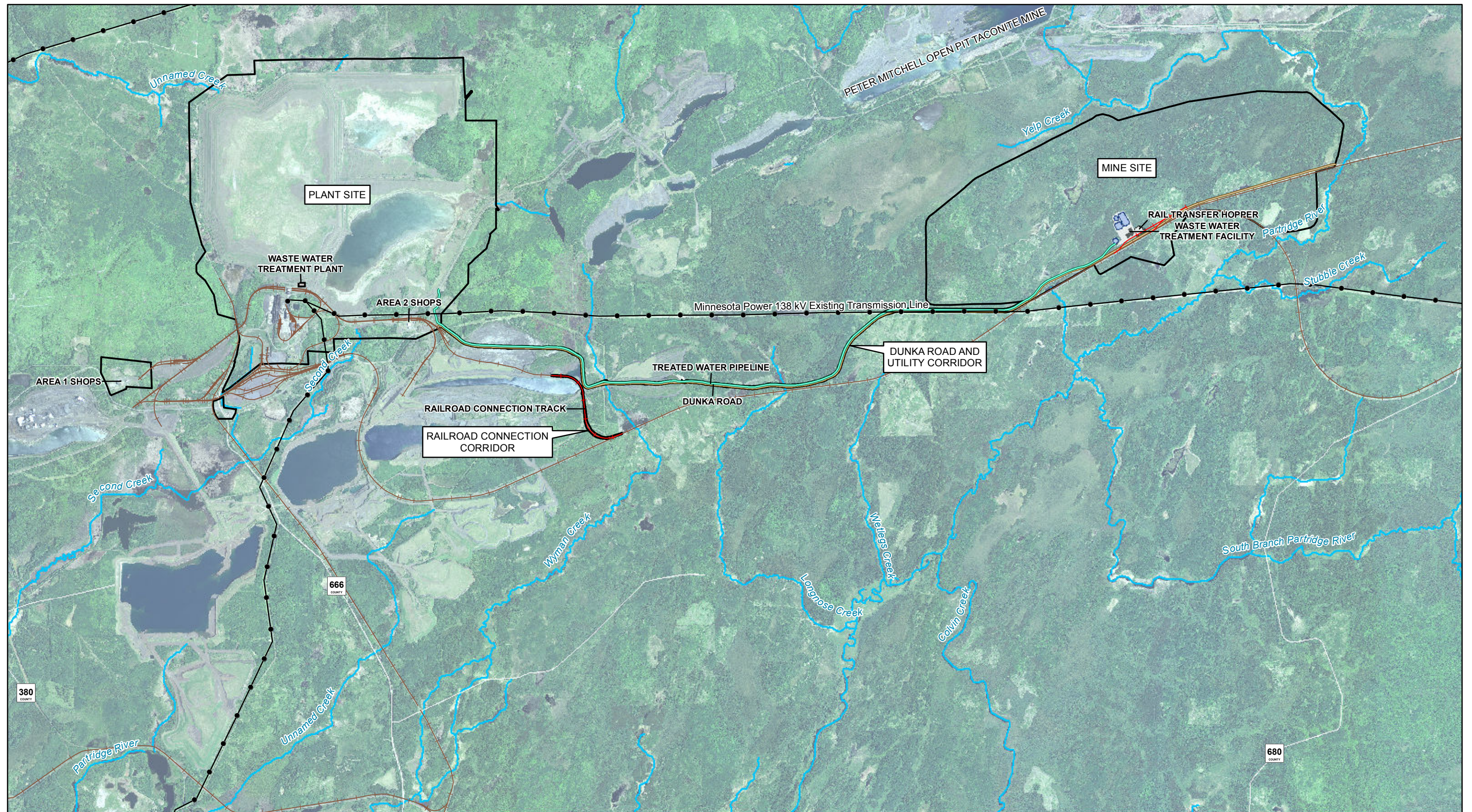
Traffic on Dunka Road would include light trucks and automobiles, sport utility vehicles (SUVs), fuel trucks, supply and waste trucks, and haul trucks needing maintenance.

- Automobiles, light trucks, or SUVs transporting employees would travel between the Area Two Shops and the Mine Site each day, at speeds of 30 to 45 miles per hour.
- Trucks carrying fuel and blasting agents would travel to the Mine Site every day, at speeds of 25 to 40 miles per hour. These trucks would travel from County Highway 666 to Dunka Road.
- Trucks transporting supplies and waste to and from the Waste Water Treatment Plant and the Waste Water Treatment facility would travel between the Plant Site and the Mine Site each day, at speeds of 25 to 40 miles per hour.
- Haul trucks would travel from the Mine Site to the Area 1 Shop for maintenance occasionally, at a maximum speed of 35 miles per hour.

2.1.4.2 Railroad Connection Corridor

The railroad route from the Mine Site to the Plant Site would be from a new spur at the Rail Transfer Hopper, to the existing track on the Cliffs Erie private railroad, to a new approximately 1.1 mile connecting railroad track between the Cliffs Erie railroad track and existing PolyMet track railroad that serves the Coarse Crusher Building at the Process Plant (**Figure 6**).

Each ore train would consist of 16 to 20 100-ton side dumping ore cars and one diesel-electric “Gen-Set” or “Multi-Engine” locomotive. Ore trains would make approximately 22 roundtrips per day delivering ore from the Mine Site to the Plant Site, traveling between 15 to 25 miles per hour.



- Dunka Road
- +— Existing Private Railroad
- +— Proposed Railroad Track
- Treated Water Pipeline
- Electric Transmission Lines
- Project Areas



0 2,250 4,500 9,000
Feet

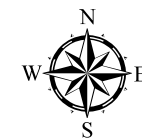


Figure 6
Transportation and Utility Corridor
Biological Evaluation for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

To minimize the amount of ore that escapes from rail cars, ore would be loaded into the center of the car so that fines would be located at the center of the car and the larger ore pieces would be at the edge. The result would be that fines would be kept from reaching the edge of the car where they would be subject to spillage through the hinge gaps. Large pieces that extend over the edge of the rail car would be pushed into the center of the car using a rubber-tired dozer or a front-end loader. In the event that a large ore piece would fall over the top edge of the cars during transit, it would be recovered during routine track maintenance.

In order to guard against possible adverse impacts from spilled ore, monitoring and mitigation activities can be developed. It is expected that the surface water quality sampling in the two streams traversed by the rail line would be included in permit monitoring. Mitigation measures could include alterations to the stream crossings (bridges or culverts) to collect any spilled material or the physical collection of spilled ore from the top of the rail ballast.

2.1.5 Traffic

Transportation of Project consumables and products would result in traffic on public roads and commercial railroads. Public roads would also have additional traffic from employees and service providers.

2.1.5.1 Transport of Consumables and Products

Process consumables and products would be transported to and from the Plant Site by truck and by rail. This section describes the traffic on public roads and commercial railroad lines that would result from the Project.

Trucks transporting raw materials needed for the beneficiation process and the hydrometallurgical process would make approximately 80 round trips per month, entering the Plant Site from Highway 135. Trucks transporting copper and nickel concentrates would make up to approximately four round trips per day, also entering the Plant Site from Highway 135.

A locomotive, similar to the locomotives that would be hauling ore from the Mine Site to the Plant Site, would transfer loaded and empty cars carrying process consumables and concentrates to and from the interchange location with the Canadian National Railroad. Cars carrying process consumables and concentrate would meet railroad common carrier requirements.

Product shipment would require an approximately 100-car train once per month and a 30-car train 4 times per month, year-round. Process consumables would require an approximately 100-car train once per week, April through October. It is expected that outgoing PolyMet products would go by rail from the Plant Site to Virginia, Minnesota, with about half going south to Duluth, Minnesota, and the other half going north to International Falls, Minnesota. Product transport beyond Virginia is likely to be a part of the existing commercial rail traffic, with limited potential to generate additional commercial train trips. Process consumables would arrive at the Plant Site from the south from Duluth through Virginia. This movement is likely to be a part of the existing commercial rail traffic, with limited potential to generate additional commercial train trips.

2.1.5.2 Traffic from Employees and Service Providers

The Project would employ as many as 500 full-time workers over an 18-month period during peak construction period, and about 360 full-time workers during operation. There would be approximately 38 employee vehicles per day and 4 service vehicles per day entering the Main Gate (from County Road 666). In

addition, there would be approximately 113 employee vehicles per day and 36 service vehicles per day entering the North Gate (from Highway 135).

2.1.6 Project Reclamation

Mining is expected to be completed approximately 20 years after operations begin. This section summarizes information from the Reclamation Plan, which is a support document for the MDNR Permit to Mine, and focuses on those aspects of Project Reclamation that have potential effects on RFSS. Additional information on Project reclamation is available in the FEIS (MDNR et al. 2015).

In general, Project facilities have been designed and would be operated to allow for progressive reclamation, or “mining in a manner that creates areas that can be reclaimed as soon after initiation of the operation as practical and as continuously as practical throughout the life of operation” (Minnesota Rules, part 6132.0100). This would leave a smaller portion of the Project area needing to be reclaimed after closure. Project features that would be progressively reclaimed include the Waste Rock Stockpiles, the East Pit, exterior slopes of the Flotation Tailings Basin, and the Hydrometallurgical Residue Facility. The Waste Water Treatment Facility and the Waste Water Treatment Plant would remain operative during reclamation and long-term closure⁵.

2.1.6.1 Building and Structure Demolition and Equipment Removal

The buildings and structures would be removed and foundations razed. All mining, dewatering, and electrical equipment would be removed from the mine pit and scrapped, decommissioned, or sold. Debris and equipment would be removed from the Mine Site and Plant Site. Most roads, parking areas, or storage pads built to access these facilities would be demolished. Utility tunnels would be sealed and reclaimed in place. After demolition, these areas would be reclaimed and vegetated according to Minnesota Rules, part 6132.2700. All areas would be stabilized as required for stormwater management.

Demolition waste from structure removal would be disposed of in the existing on-site demolition landfill located northwest of the Area 1 Shop. Most concrete from demolition would be crushed and used for structural fill, placed in the basements of the Plant Site buildings, or placed in the existing on-site industrial landfill. Asphalt from paved surfaces would be removed and recycled or properly disposed of. Railroad track and ties that were not used by common carriers would be removed and recycled. All disturbed areas would be reclaimed and vegetated.

Any roads, including Mine Site access roads that may develop into unofficial off-road vehicle trails, would require a variance from MDNR reclamation rules to allow a 15-foot-wide unpaved, unvegetated track down the centerline of the road. Such approvals would also be coordinated with the St. Louis County Mine Inspector’s Office.

Special materials would be disposed of appropriately during reclamation:

- Any ore remaining in the Rail Transfer Hopper, the Ore Surge Pile, or anywhere else in the

⁵ “Long-term closure” is defined as being the time period when the West Pit has filled with water and the Waste Water Treatment Facility is discharging water to the outlet channel to the Upper Partridge River. This will likely occur during the post-closure maintenance period of reclamation.

vicinity of the Rail Transfer Hopper, as well as sediment removed from ditches and process water ponds, would be placed in the East Pit.

- Asbestos-containing materials would be removed intact, properly packaged, and disposed of in the on-site demolition landfill. The locations of asbestos-containing materials in the landfill would be noted on the property deed. Any asbestos-containing materials found in utility tunnels would be sealed before the utility tunnel is sealed.
- Fluorescent and sodium halide bulbs, nuclear sources, oil-stained concrete, and partially used paint, chemical, and petroleum products would be removed and recycled or properly disposed of.
- Any materials remaining in storage tanks would be sent to appropriate recycling or waste disposal facility. All storage tanks would be cleaned, disassembled, and recycled or disposed of appropriately. Tank foundations would be removed and all disturbed areas would be vegetated.
- Material remaining in the equipment and process piping would be properly disposed of in the Hydrometallurgical Residue Facility or other MPCA-approved locations.
- On-site sewer and water systems, powerlines, pipelines, and culverts would be closed according to regulatory requirements.

2.1.6.2 Reclamation of Mine Site

Mine Site reclamation would include building and structure demolition and equipment removal, mine pit reclamation, stockpile reclamation and watershed restoration. Mine Site reclamation would begin as soon as practical throughout operations, with reclamation of the East Pit and Waste Rock Stockpiles commencing before mining activities cease.

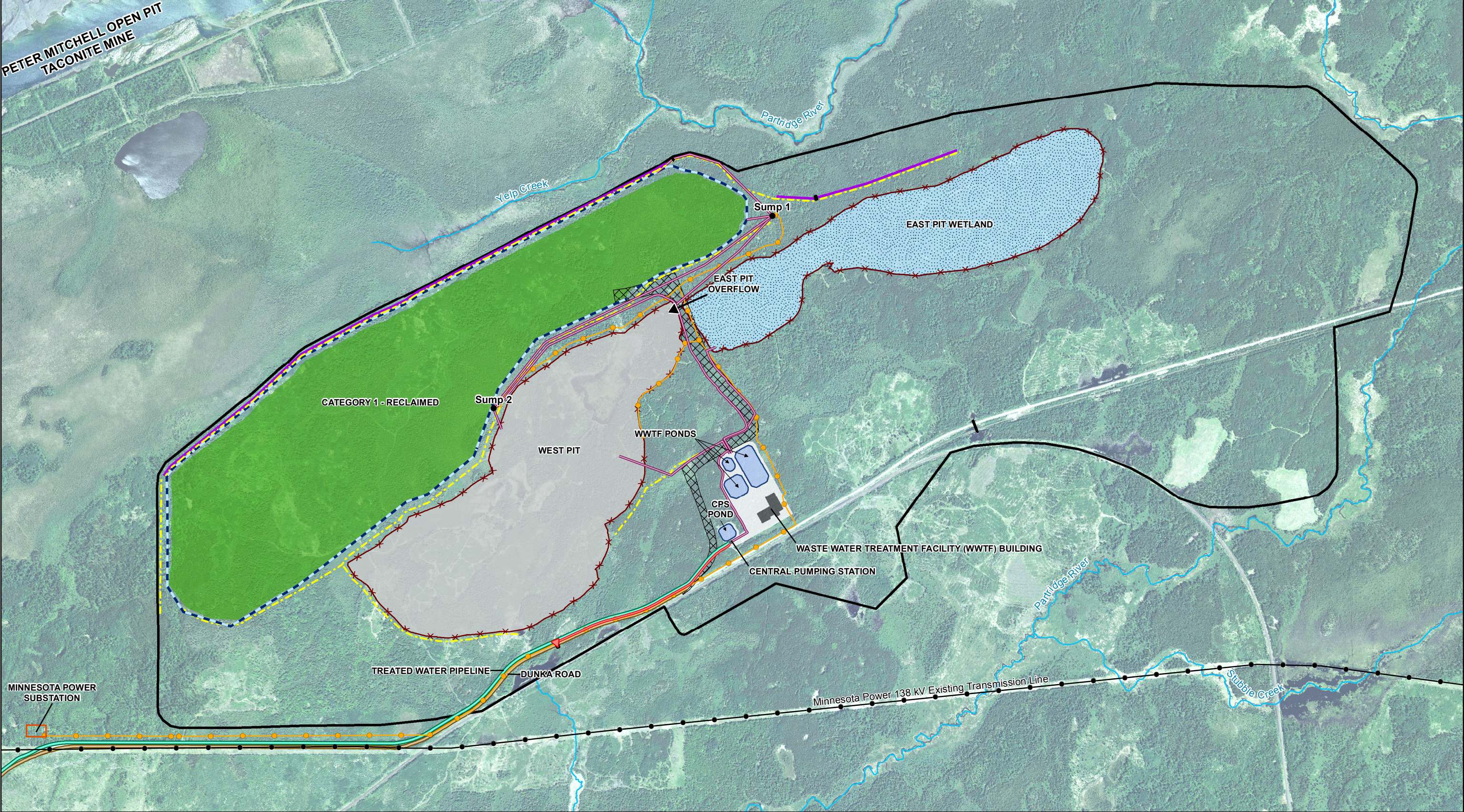
Mine Pit Reclamation

Mine pit reclamation would include pit flooding, construction of overflows and outlet control structures, sloping and vegetation of pit walls, and fencing to control access to the pits. East Pit reclamation would begin during operations, while West Pit reclamation would commence when mining activity ceases.

Mine pit dewatering systems would be removed from the pits and the pits would be allowed to flood with water. All areas disturbed during pipe removal would be graded and revegetated. Some temporary pumps may remain in the pits for dewatering that would be performed during pit flooding.

East Pit flooding would start in Mine Year 11 and be completed by Mine Year 20. Overflow from the East Pit would flow to the West Pit through a new ditch. An East Pit outlet structure would be built, which would establish the steady-state water level in the East Pit. The East Pit would be revegetated with wetland vegetation, resulting in approximately 207 acres of wetland (**Figure 7**).

Upon completion of mining operations, the West Pit would begin to flood naturally with groundwater, precipitation, and surface runoff from the tributary watershed. West Pit flooding would be accelerated with treated and untreated water from the Plant Site. With the addition of water pumped from the Plant Site to the



- | | | |
|-------------------|--------------------------------|----------|
| Mine Site | Groundwater Containment System | Culverts |
| Covered Stockpile | Process Water Pipe | Fence |
| West Pit | Stormwater Collection Ditch | |
| East Pit Wetland | Perimeter Dike | |
| Haul Roads | Discharge Pipe | |

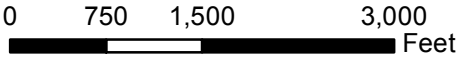


Figure 7
Mine Site Plan Long-term Closure
Biological Evaluation for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

West Pit, West Pit flooding is projected to be completed between Mine Years 40 and 45. The West Pit would remain an open pit lake (MDNR et al. 2013).

When the West Pit is full, discharge would be prevented by pumping West Pit water to the Waste Water Treatment Facility for treatment. The Waste Water Treatment Facility would be upgraded to include reverse osmosis or similar membrane separation technology to achieve an effluent concentration that meets the sulfate standard for waters used for the production of wild rice (10 mg/l). After the upgrade, effluent would be discharged through Dunka Road into an existing wetland and eventually into the Partridge River through an existing tributary channel.

The overburden portions of the pit walls would be sloped, graded, and vegetated in accordance with Minnesota Rules, part 6132.2300. Lift heights would be selected based on the need to protect public safety, the location of the pit wall in relation to the surrounding land uses, the soil types and their erosion characteristics, the variability of overburden thickness, and the potential use of the pit following mining.

A pit perimeter fencing system would be installed consisting of fences, rock barricades, ditches, stockpiles, and berms. The barrier system plan would be submitted to the St. Louis County mine inspector for review and approval before installation. Safe access would be provided to the bottom of each mine pit via selected haul roads built during pit development. The access road would be selected such that, as pit water level rises, there would always be a clear path to the water surface. A gated entrance would be placed at each pit access location.

Stockpile Reclamation

Stockpile reclamation would begin during operations. Upon full reclamation of the Category 1 Waste Rock Stockpile, runoff from the top and sides of the stockpile would be classified as non-contact stormwater and discharged into the natural drainage system. The Category 1 Waste Rock Stockpile Groundwater Containment System would continue to collect drainage from the stockpile during reclamation, with drainage treated at the Waste Water Treatment Facility.

Watershed Restoration

During mining operations, stormwater runoff from reclaimed stockpile areas and natural (undisturbed) areas would be routed via dikes and ditches to stormwater sedimentation ponds. During reclamation, dikes and ditches that were no longer needed would be removed or filled and ponds would be filled. The reclaimed surfaces would then be scarified, topsoil placed on the surface, and the area revegetated with native species.

Surface runoff inflows would be routed to the mine pits using a combination of existing and new ditches. Some portions of the pit rim dikes may be left in place, if needed, to prevent an uncontrolled flow to or from the pits and potential erosion (head cutting) of the pits walls.

All stormwater ponds, the Overburden Storage and Laydown Area process water pond, haul road process water ponds, and all stockpile sumps and overflow ponds would be filled with overburden and peat (that was removed from the site during construction and stored in the Overburden Storage Area), and covered with topsoil and revegetated or converted into wetlands. If the process water ponds were converted into wetlands, any sedimentation that occurred within the pond would be evaluated to determine if removal of sediment or covering of the pond would be necessary prior to restoration. Stormwater pond outlet control structures would remain in place as necessary to manage water flows.

2.1.6.3 Reclamation of Plant Site

Plant Site reclamation would include building and structure demolition and equipment removal, Flotation Tailings Basin reclamation, and Hydrometallurgical Residue Facility reclamation. Similar to the Mine Site,

Plant Site facilities have been designed and would be operated to allow for progressive reclamation. Features that would remain at the Plant Site are shown on **Figure 8**.

The Waste Water Treatment Plant, Flotation Tailings Basin Seepage Management Systems, and Hydrometallurgical Residue Facility Leakage Collection System would continue to operate during reclamation, although seepage rates would be progressively reduced. Seepage would be recycled back into the Flotation Tailings Basin Pond or treated at the Waste Water Treatment Plant and pumped to the Mine Site to aid in West Pit flooding, or discharged.

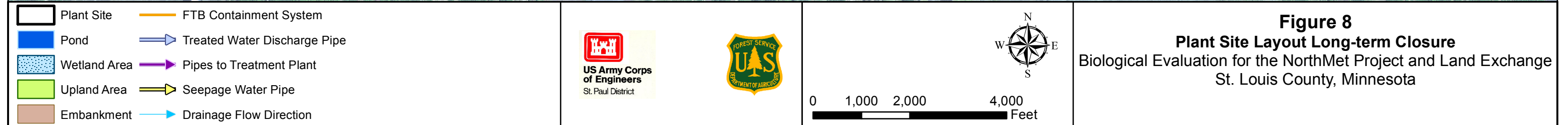
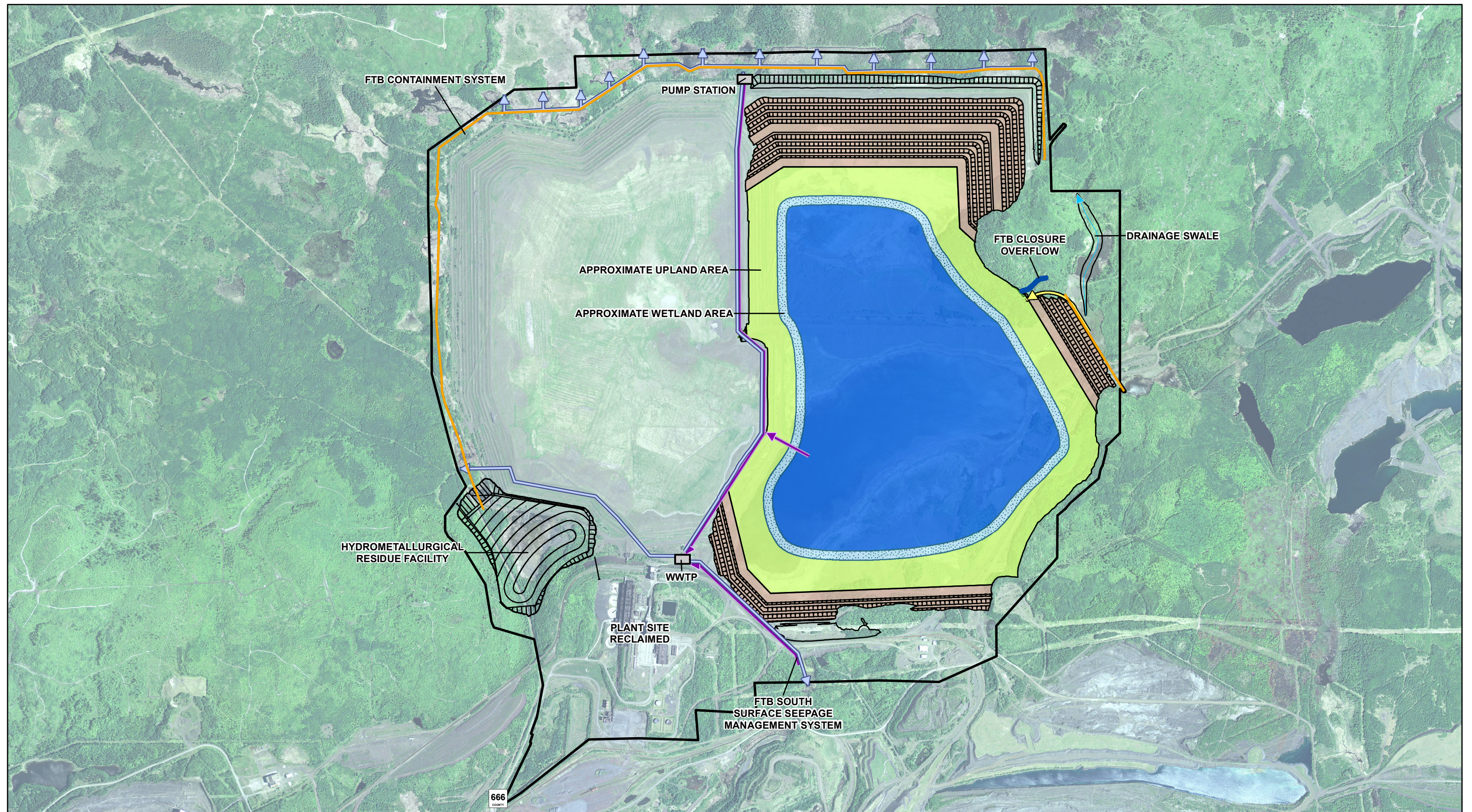
Flotation Tailings Basin Reclamation

Permanent vegetation would be established on the Flotation Tailings Basin to control fugitive dust. Flotation Tailings Basin exterior dam surfaces would be reclaimed progressively, while interior areas would be seeded and mulched after closure.

Infiltration would be reduced through the dam faces, beaches, and pond bottom of the Flotation Tailings Basin by bentonite amendment. The exterior faces of the dams would be reclaimed progressively, with a bentonite layer added as they are constructed to limit oxygen diffusion. The exposed beaches and dam tops would be amended with a bentonite layer to limit oxygen diffusion. The pond bottom would be covered with a bentonite layer to maintain a permanent pond that would limit oxygen diffusion.

During reclamation, several sources of water from the Flotation Tailings Basin would require management. The sources and a summary of the type of management needed are described as follows:

- Pounded water within the Flotation Tailings Basin – a pond and wetland would remain in the Flotation Tailings Basin. The pond and wetland would receive surface water runoff from the crest and beaches of the basin and natural terrain adjacent to the Flotation Tailings Basin. The pond and wetland would continue to lose water via seepage, but at a reduced rate as compared to during operations as a result of the bentonite augmentation of the Flotation Tailings Basin pond bottom. Excess water would be pumped from the Flotation Tailings Basin pond to the Waste Water Treatment Plant for treatment prior to discharge.
- Stormwater management would include grading to provide a gently sloping surface that effectively routes surface water runoff to the interior of the Flotation Tailings Basin, and to accommodate future differential settlement of the underlying Flotation Tailings.
- An emergency overflow channel would be constructed to carry stormwater from the pond to the adjacent wetland in case of an extreme storm or snowmelt event after reclamation. The conceptual location of the emergency overflow channel is from the combined Cell 1/2E to the adjoining land.



Hydrometallurgical Residue Facility Reclamation

Hydrometallurgical Residue Facility reclamation would include removal of ponded water from the Hydrometallurgical Residue Facility cell surface, removal of pore water from the residue, construction of the cell cover system, establishment of vegetation, and surface water runoff controls.

Ponded water remaining in the cell would be removed and treated at the Waste Water Treatment Plant. Drainage would be collected from the base of the cell at the geocomposite drainage system and managed as described for ponded water. The rate of drainage would decrease over time as the pore water within the Hydrometallurgical Residue Facility was collected and removed.

The hydrometallurgical cell area would be graded into a gently sloping surface, and an engineered cover system would be installed to limit infiltration. Permanent vegetation would be established over the cover system. The turf and final cover would be inspected, mowed once per year or as needed, fertilized if vegetation growth is poor, and repaired as needed.

The cover would slope gently toward the site perimeter to accommodate natural drainage of the runoff. Final cover slopes on the cell interior would be relatively shallow to minimize surface water runoff flow velocity and the associated erosion. Runoff channeled along the cell perimeter would be routed downslope via rip-rapped drainage swales or plug-resistant inlet structures and piping systems. Once runoff was conveyed down the cell exterior dam slope, it would be routed to the surrounding natural drainage system. All runoff would be from reclaimed cover or dam exterior slopes, which would be constructed of MDNR-approved material.

2.1.6.4 Long-Term Closure Activities

Mechanical water treatment systems (the Waste Water Treatment Facility and the Waste Water Treatment Plant) would continue to operate during long-term closure. The water collected by the Category 1 Waste Rock Stockpile Groundwater Containment System and the West Pit water would be treated using the Waste Water Treatment Facility (upgraded to reverse osmosis or similar membrane separation technology) to ensure that the discharge meets applicable water quality discharge limits. The Waste Water Treatment Plant would treat water collected by the Flotation Tailings Basin seepage capture systems, Hydrometallurgical Residue Facility Leakage Collection System, and excess Flotation Tailings Basin pond water, to meet applicable water quality discharge limits. Inspection, water treatment maintenance, and reporting activities would continue while the mechanical treatment systems operated during long-term closure.

Surface water and groundwater quality would be monitored. These long-term closure activities would be expected to be ongoing until such time as the various facility features are deemed environmentally acceptable, in a self-sustaining and stable condition.

Other long-term closure activities would include repair of stockpile and Flotation Tailings Basin dam slope erosion, up-keep of constructed wetlands and outflow structures, removal of shrubs and trees from the Hydrometallurgical Residue Facility and Category 1 Waste Rock Stockpile cover systems, and on-going operation/maintenance and inspection of the seepage capture systems at the Category 1 Waste Rock Stockpile and Flotation Tailings Basin.

When PolyMet has completed all reclamation and long-term closure activities required under the Permit to Mine, a Request for Release per Minnesota Rules, part 6132.1400 would be submitted to the MDNR. This

request would provide the Commissioner of the MDNR with detailed information on the final closure status of the Project.

2.1.7 Federal and Non-federal Lands

2.1.7.1 Land Exchange Process

As part of the Project, the Forest Service is considering transferring approximately 6,495 acres of federal lands to PolyMet in exchange for non-federal lands of similar value that have been offered for consideration by PolyMet (**Figures 2 and 3**).

The federal lands are in St. Louis County, approximately 60 miles north of the City of Duluth, 20 miles south of the Boundary Waters Canoe Area Wilderness (BWCAW), and 6 miles south of the City of Babbitt, Minnesota. The federal lands are bounded on the north by the Northshore taconite mine and on the south by the Dunka Road and Utility Corridor.

The proposed land exchange between the Government, acting through the Forest Service, and PolyMet is an assembled land exchange. The land exchange is proposed under the authority of the Weeks Act of March 1, 1911 as amended; General Exchange Act of March 20, 1922; Federal Land Exchange Facilitation Act of 1988; and the Federal Land, Policy and Management Act of October 21, 1976.

The proposed land exchange complies with the 2004 Forest Plan (USDA Forest Service 2004a). The federal lands are located within the General Forest and General Forest - Longer Rotation Management Area. The theme of the General Forest – Longer Rotation Management Area emphasizes land and resource conditions that provide a wide variety of goods, uses and services. The characteristics and use of the General Forest Management Area are similar to the General Forest – Longer Rotation Management Area, except that harvests are more frequent, more uniform in age, and more extensive. The General Forest Management Area has the highest amount of young forest and the largest-sized timber harvest units. Forested habitats on the federal lands can be categorized using the Forest Service’s Management Indicator Habitat (MIH), which describes dominant species, stand age class (young, immature, and mature), and stand condition (USDA Forest Service 2010a).

Land ownership adjustment direction for the General Forest and General Forest - Longer Rotation Management Area allows for the exchange of federal lands, with the desired condition described as “Land ownership patterns (federal, state, county, corporation and private) are consolidated, promote efficient administration and reduce the costs of managing resources.”

2.1.7.2 Federal Lands

The federal lands include approximately 2,719 acres of the 3,015-acre Mine Site and 3,776 acres of lands surrounding the Mine Site that are owned by the Government and administered by the Forest Service (**Figure 3**). The federal lands are located in Township 59 North, Range 12 West, Sections 6 and 7; Township 59 North, Range 13 West, Sections 1-12, 17, and 18; and Township 60 North, Range 13 West, Sections 33, 34, and 35 (**Figure 1**). Most of the federal lands are part of the General Forest – Longer Rotation Management Area, while the remainder is within the General Forest Management Area.

DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

The federal lands include a portion of One Hundred Mile Swamp, a large black spruce, tamarack, and northern white cedar wetland, and Mud Lake. Yelp Creek and the Partridge River flow through the federal lands on the north, east, and southeast. Management of the 3,776 acres of federal lands surrounding the Mine Site may include some upland timber management to enhance wildlife habitat, however, wetland areas would be maintained in their natural state for the foreseeable future.

2.1.7.3 Non-federal Lands

PolyMet has acquired non-federal lands for transfer to the Government that encourage efficient land ownership patterns, with the desired condition of consolidating federal, state, county, corporate and private ownership to promote efficient administration and reduce the cost of managing resources to the Forest Service. The non-federal lands would be incorporated with adjacent federal ownership and managed in accordance with 2004 Forest Plan direction for that particular area (USDA Forest Service 2004a). Lands with obvious recreational values would be managed to enhance those public recreation opportunities. The non-federal lands assembled include five different lands totaling approximately 7,075 acres that are comprised primarily of forest and wetland habitat (**Figure 2**).

Hay Lake Lands

Hay Lake Lands are in central St. Louis County, Minnesota, and are approximately 3 miles west of Biwabik, Minnesota. The lands, located at the eastern end of the Mesabi Iron Range, include approximately 4,926 acres in all or portions of Sections 9, 16, 19, 20, 21, 27, 28, 29, 30, 31, and 32 in Township 59 North, Range 16 West. The lands are moderately hilly and consist predominantly of second- or third-growth deciduous and coniferous forest uplands and emergent, shrub swamp, and forested wetlands. Approximately 59% (2,931 acres) of the Hay Lake Lands consists of wetlands. The lands include Hay Lake, identified as a Wild Rice Water by the MDNR, and Little Rice Lake, and are bordered on the east by the Pike River. The Superior National Forest borders the lands to the north, east, and west. Forest Service lands adjacent to Hay Lake Lands are managed as General Forest and Candidate Research Natural Areas. Research Natural Areas are areas that the Forest Service has designated to be permanently protected and maintained in natural condition. These protected natural areas include unique ecosystems or ecological features; rare or sensitive species of plants and animals and their habitat; and/or high-quality examples of widespread ecosystems. Candidate Research Natural Areas are those areas which are in various stages of review for possible establishment as a Research Natural Area.

Hunting Club Lands

Hunting Club Lands are in northern St. Louis County, Minnesota, and include approximately 160 acres in Section 17, Township 66 North, Range 17 West. The lands are nearly level and consist predominantly of second- or third-growth deciduous and mixed coniferous/deciduous forest uplands and emergent, shrub swamp, and forested wetlands. Approximately 40% (64 acres) of Hunting Club Lands consists of wetlands. The lands are bordered by Forest Service and county lands. Nearby Forest Service lands are managed as General Forest – Longer Rotation.

Lake County Lands

Lake County Lands consist of approximately 382 acres, with 265 acres in Sections 5 and 6, Township 57 North, Range 11 West (Lake County Lands North), and 117 acres in Section 17, Township 56 North, Range 9 West (Lake County Lands South) in Lake County, Minnesota. The lands are administered by Lake County. The lands

are nearly level and consist predominantly of second- or third-growth mixed coniferous/deciduous forest uplands and bog, emergent, shrub swamp, and forested wetlands. Much of Lake County Lands South was recently logged. Approximately 74% (283 acres) of Lake County Lands consists of wetlands. The lands are bordered by the Superior National Forest. Forest Service lands near Lake County Lands North are managed as Riparian Emphasis Area and General Forest – Longer Rotation. Forest Service lands near Lake County Lands South are managed as General Forest – Longer Rotation. In Riparian Emphasis Areas, riparian ecological functions are actively restored, protected, and enhanced in areas where ecosystem processes are sensitive to degradation. This includes maintaining and restoring native vegetation communities; maintaining and restoring riparian/hydrologic functions such as shoreline stability, wildlife habitat, coarse woody debris recruitment to aquatic and riparian ecosystems, and temperature regulation; and controlling non-native invasive species. Restoration focuses on components of the ecosystem that are not functioning at or within the range of desired conditions. Those components that are functioning properly are protected. These areas are also managed for recreational opportunities and visual quality adjacent to bodies of water.

McFarland Lake Lands

McFarland Lake Lands are approximately 31 acres in Section 9, Township 64 North, Range 3 East, in Cook County, Minnesota. The lands are approximately 3 miles west of the U.S. - Canada border and 10 miles north of Hovland, Minnesota. The lands are mostly on a hillslope and consist of second- or third-growth deciduous and coniferous upland forest. McFarland Lake is an entry point to the BWCAW. There are no wetlands on the lands. The lands are bordered by Forest Service lands, which are managed as General Forest – Longer Rotation.

Wolf Lands

Wolf Lands total 1,576 acres and are comprised of 126 acres in Section 8, Township 57 North, Range 11 West (Wolf Lands 1); 769 acres in Sections 15 and 22, Township 58 North, Range 10 West (Wolf Lands 2); 277 acres in Sections 30 and 31, Township 59 North, Range 9 West (Wolf Lands 3); and 405 acres in Sections 7, 8, 15, 17, and 18, Township 59 North, Range 9 West (Wolf Lands 4) in Lake County, Minnesota. The lands are nearly level and consist predominantly of second- or third-growth mixed coniferous/deciduous forest uplands and bog, emergent, shrub swamp, and forested wetlands. Much of Wolf Lands 3 has been recently logged. Approximately 88% (1,393 acres) of Wolf Lands consists of wetlands. Forest Service lands border portions of all of Wolf Lands and are managed as General Forest (Wolf Lands 2, 3, and 4) and General Forest – Longer Rotation (Wolf Lands 1). Wolf Lands would supplement National Forest ownership by reducing federal exterior boundaries and would eliminate several private in-holdings.

2.2 Land Exchange Alternative B (Alternative B)

Alternative B was derived from the Mine Site Exchange-Only Alternative Proposed Action (refer to Sections 3.3.3.2 and 3.3.3.3.4 of the FEIS) that was developed to address concerns raised during scoping. This alternative would convey fewer acres of federal lands to the Government for fewer acres of non-federal land from PolyMet.

Land exchanges are based on equal value. Because there would be fewer federal acres available to be conveyed by the Government, there would be fewer acres of private land that would be acquired by the Government. The Government would convey approximately 4,753 acres of federal lands to PolyMet, and the Forest Service would no longer administer these lands. The Government would acquire approximately 4,926 acres of Hay Lake Lands (identified as Tract 1 – Hay Lake Lands in the FEIS). Hay Lake Lands were selected for this alternative for the following reasons:

- they would be almost equal in size to the smaller federal lands,
- they would provide wetlands, and
- it is likely that Hay Lake Lands would have a higher per-acre value than the federal lands because of their access to a county road and its potential for riparian lots.

The configuration of the smaller federal lands is the smallest acreage that would meet the Purpose and Need for the Land Exchange (**Figure 2**). Under Alternative B, approximately 1,742 acres to the west of the Mine Site would remain under federal ownership. These remaining federal lands would become an isolated piece of federal land with limited or difficult access through private property. As with the Land Exchange Proposed Action, the Forest Service would reserve ownership of 181 acres of mineral rights scattered across the federal lands. These minerals are located outside of the mine pits.

2.3 Land Exchange No Action Alternative (No Action Alternative)

Under the No Action Alternative, the Project would not occur and no lands would be exchanged. The Government would not convey federal lands to PolyMet and the Forest Service would continue administering these lands as has been done in the past. The level of development and acceptable activities would continue to be regulated by Forest Service and Superior National Forest policies. Management would include vegetation management, mineral exploration, recreation, wildlife, watershed, and other uses identified in the 2004 Forest Plan. These lands are in General Forest – Longer Rotation and the General Forest Management Areas. Furthermore, under the No Action Alternative, the Government would not acquire the five tracts of non-federal lands and the non-federal lands would remain as private lands.

At the Mine Site, PolyMet would be required under exploration approvals to reclaim surface disturbance associated with exploratory and development drilling activities. Other existing surface uses would be allowed to continue consistent with 2004 Forest Plan.

No further upgrades or new segments would be constructed along the existing power transmission line, railroad, or Dunka Road, which would continue to be used by their private owners.

At the brownfield Plant Site, Cliffs Erie would be required to complete closure and reclamation activities required under an existing MDNR- and MPCA-approved reclamation program. This would include completing activities for the localized affected areas under the Minnesota Voluntary Investigation and Cleanup Program, removal of the former Plant Site building, and management of seepage at the Flotation Tailings Basin embankment.

3.0 Description of the Lands Affected by the Project

3.1 Federal Lands

Federal lands under the Proposed Action include approximately 2,719 acres at the 3,015-acre Mine Site and 3,776 acres surrounding the Mine Site that are owned by the Government and administered by the Forest Service (**Figure 3**). For Alternative B, the federal lands would include the 2,719 acres at the Mine Site and 2,034 acres surrounding the Mine Site.

The Forest Service designates and maintains data regarding MIH types on federal lands (USDA Forest Service 2004a: Appendix C, 2010a). The MIHs are based on forest type, including dominant species, stand age class, and stand condition. There are 14 MIHs, of which 13 MIHs pertain to forest habitats and 1 MIH pertains to aquatic habitats. A subset of these MIH types was used for the analysis of effects in the BE, including upland forest types (MIH 1; jack pine, red pine, white pine, balsam fir/trembling aspen-paper birch, black spruce-balsam fir, black spruce-jack pine, northern hardwoods, including oak and maple, trembling aspen, paper birch, and trembling aspen-black spruce-balsam fir); upland coniferous forest (MIH 5; all upland conifer and conifer-dominated mixed forest types); lowland black spruce-tamarack forest (MIH 9; all lowland conifer and lowland mixed conifer types dominated by black spruce or tamarack); and aquatic habitats (MIH 14; lakes, rivers, streams, pond, marshes or pools [permanent, intermittent, or seasonal]). The MIH types for the federal lands are shown on **Figure 9**, and for the non-federal lands are shown on **Figures 10 and 11**. **Tables 5 and 6** provide a summary of MIH type acreage on the federal and non-federal lands and gains and losses of MIH type acreage that would be administered by the Forest Service under the Proposed Action and Alternative B.

The MDNR developed the Gap Analysis Program (GAP) to identify land cover types (MDNR et al. 2013). The GAP land cover system is a hierarchical land classification system that organizes vegetation communities into 1-acre blocks. The GAP land cover types for the federal lands are shown on **Figure 12**, and for the non-federal lands on **Figures 13 and 14**. **Tables 5 and 7** provide a summary of GAP cover type acreage on the federal and non-federal lands and gains and losses of GAP cover type acreage that would be administered by the Forest Service under the Proposed Action and Alternative B.

Wetlands on the federal and non-federal lands were identified using the Eggers and Reed (1997) community types. Forest wetland types include coniferous bog, coniferous swamp, and hardwood swamp. Non-forested wetlands types include deep marsh, open bog, open water (includes shallow, open water and lakes), sedge/wet meadow, shallow marsh, and speckled alder thicket and shrub-carr. Wetland community types for the federal lands are shown on **Figure 15**, and for the non-federal lands on **Figures 16 and 17**. **Table 8** provides a summary of wetland community type acreage on the federal and non-federal lands and gains and losses of wetland cover type acreage that would be administered by the Forest Service under the Proposed Action and Alternative B.

3.1.1 Mine Site

The Mine Site encompasses 3,015 acres; 2,719 acres are Government owned while 296 acres are privately owned (**Figure 3**). The Mine Site has little topographic relief. The site consists of a mosaic of slightly elevated upland areas surrounded by wetlands, with the northern portion of the site sloping toward the east-northeast and the remainder of the site sloping to the south-southwest, in the direction of the Partridge River. About 57% of the Mine Site is upland habitat, and 43% is wetland habitat (PolyMet 2014a).

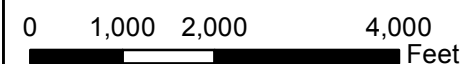
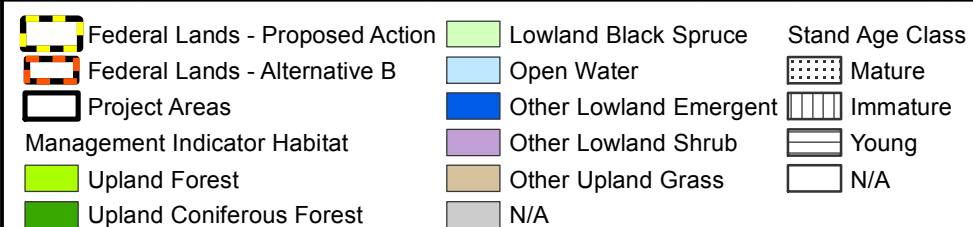
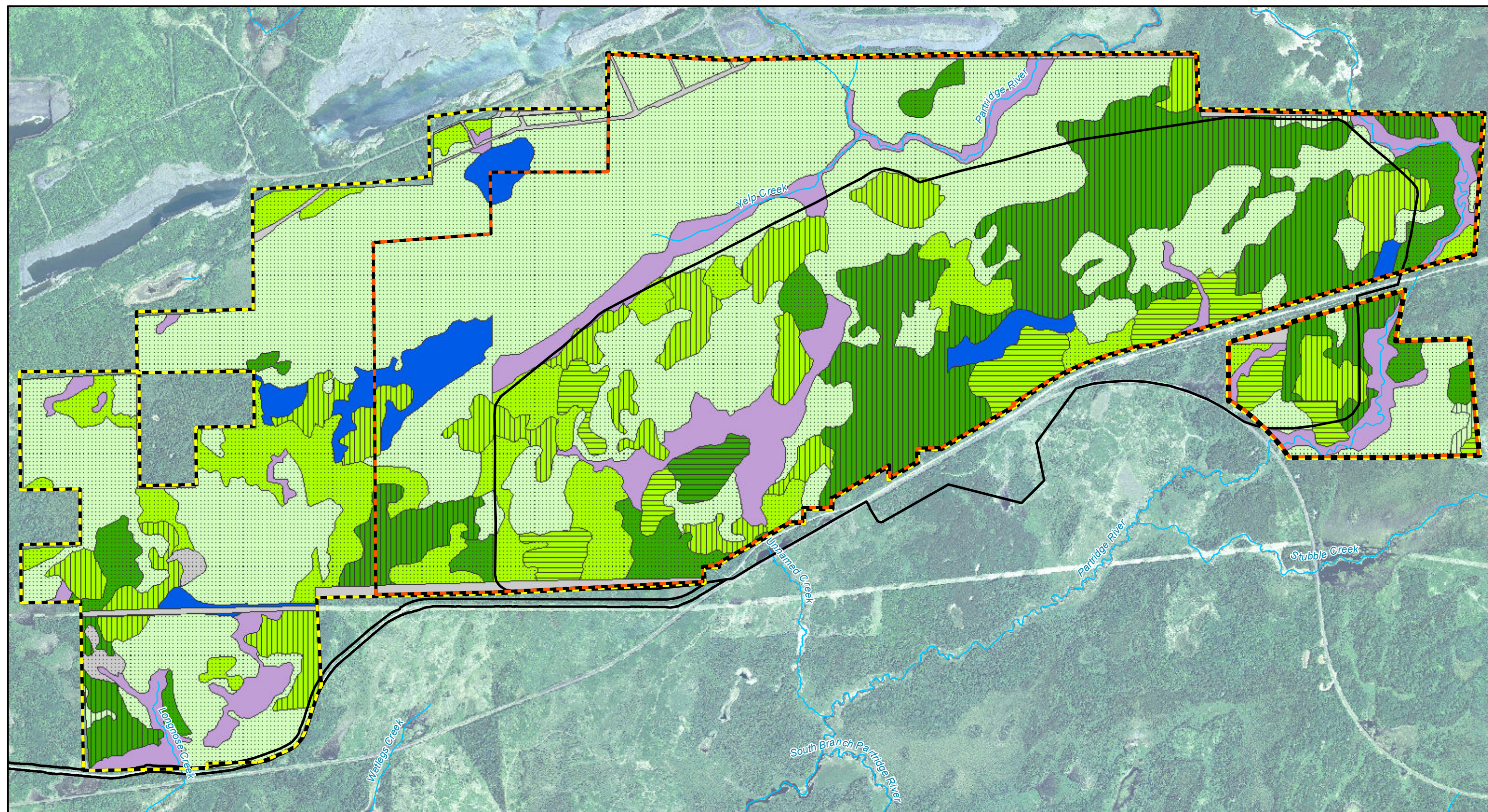
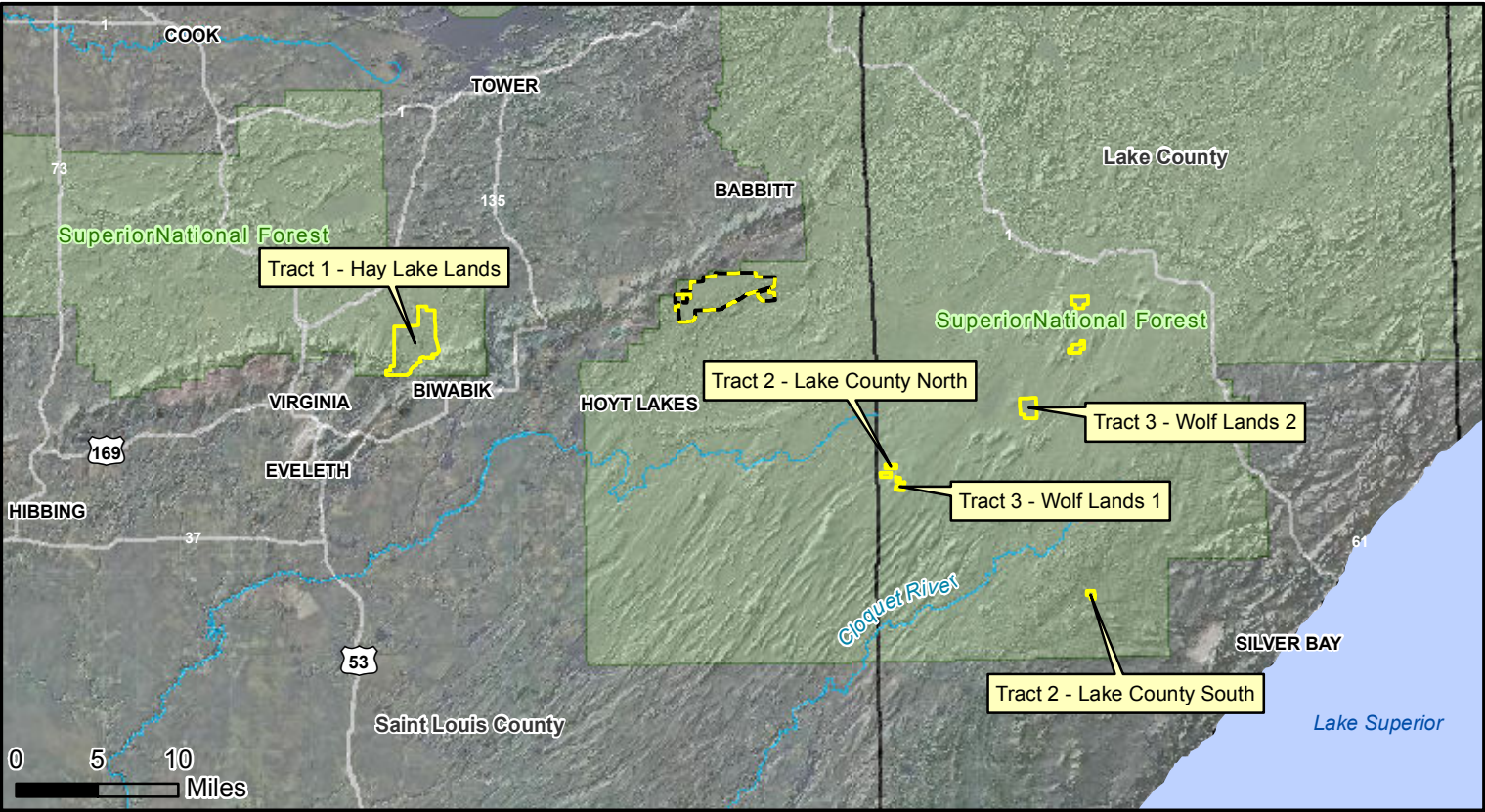
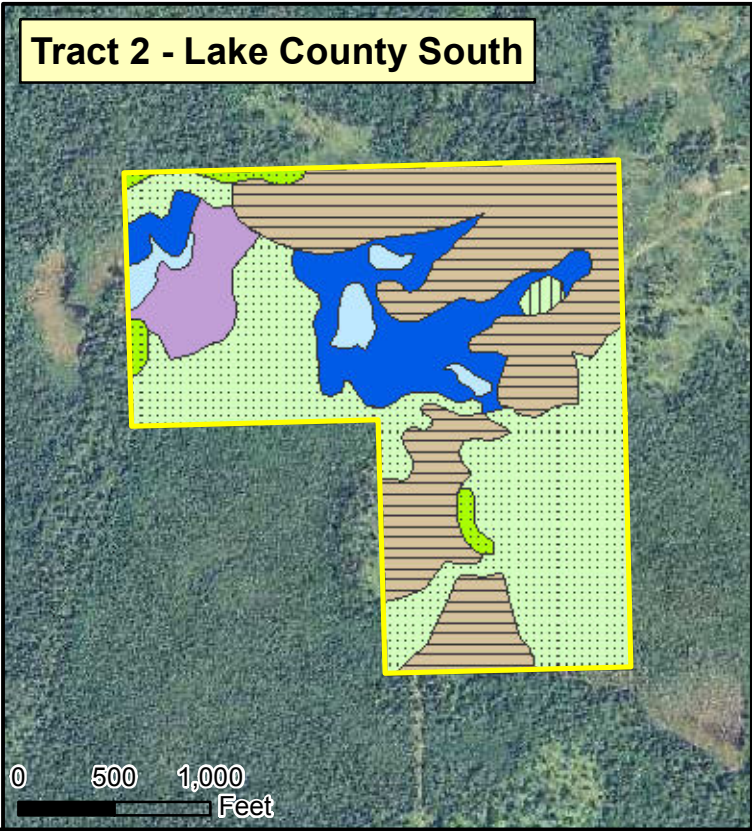
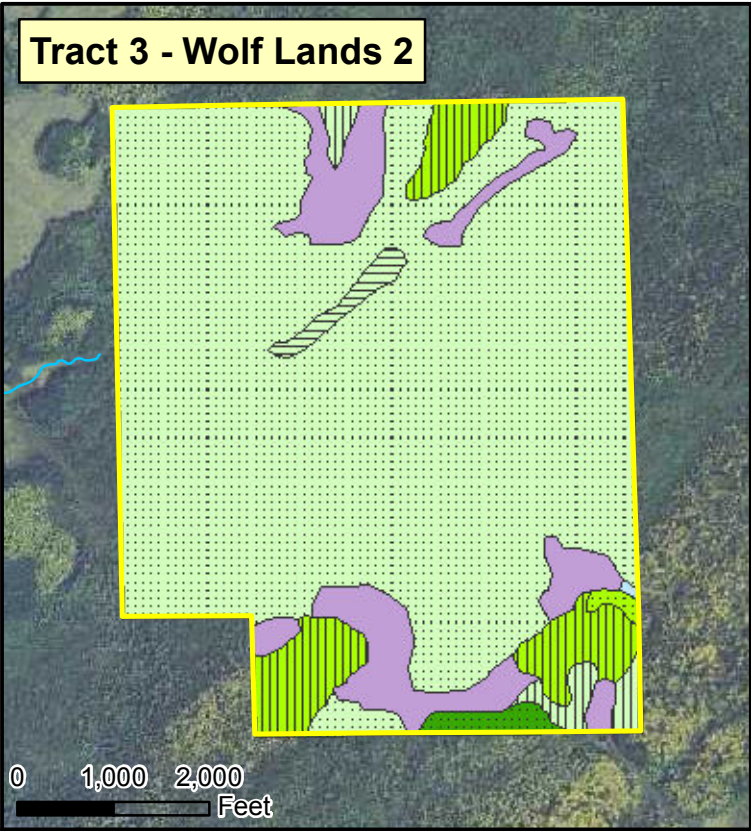
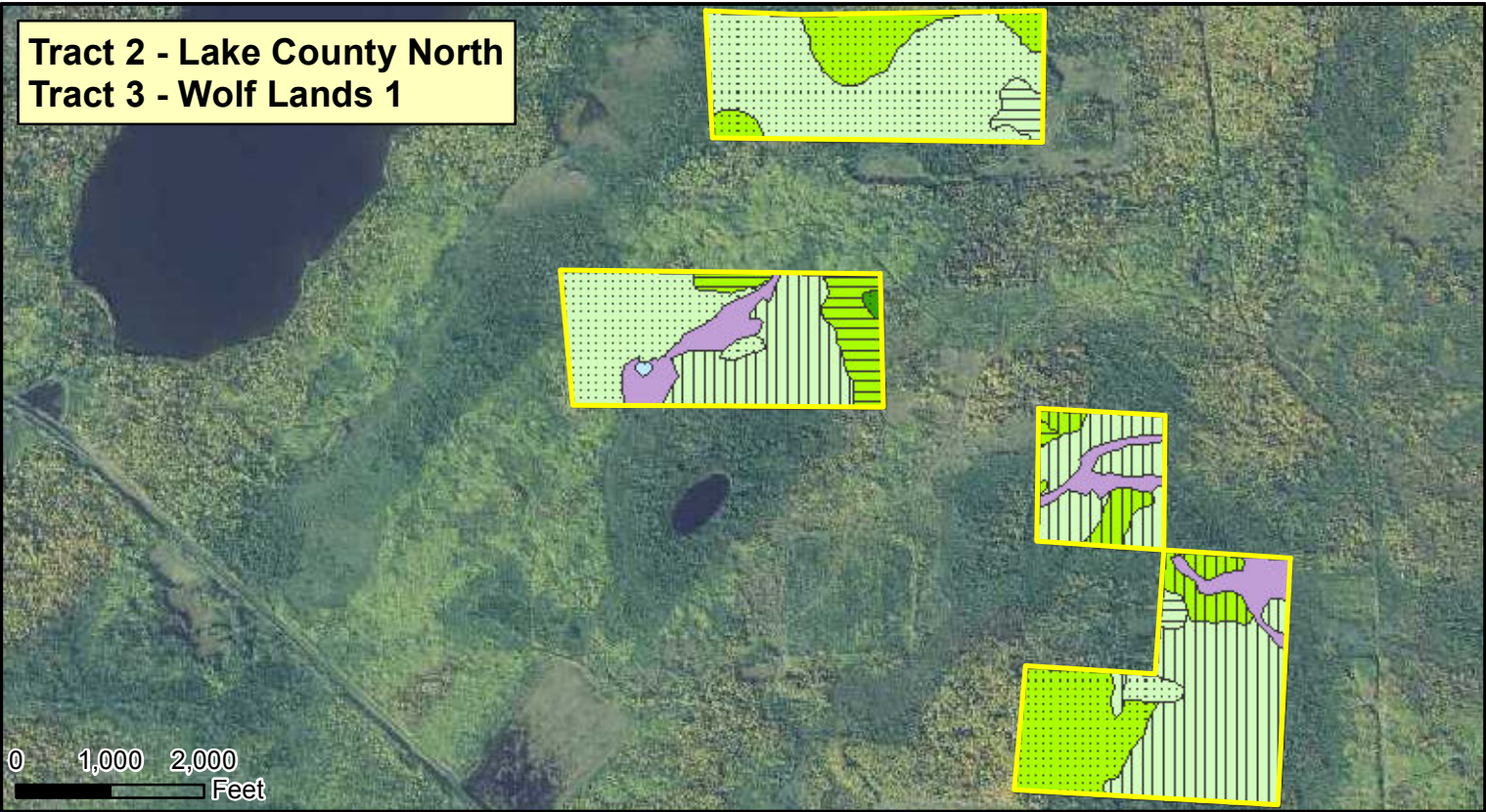
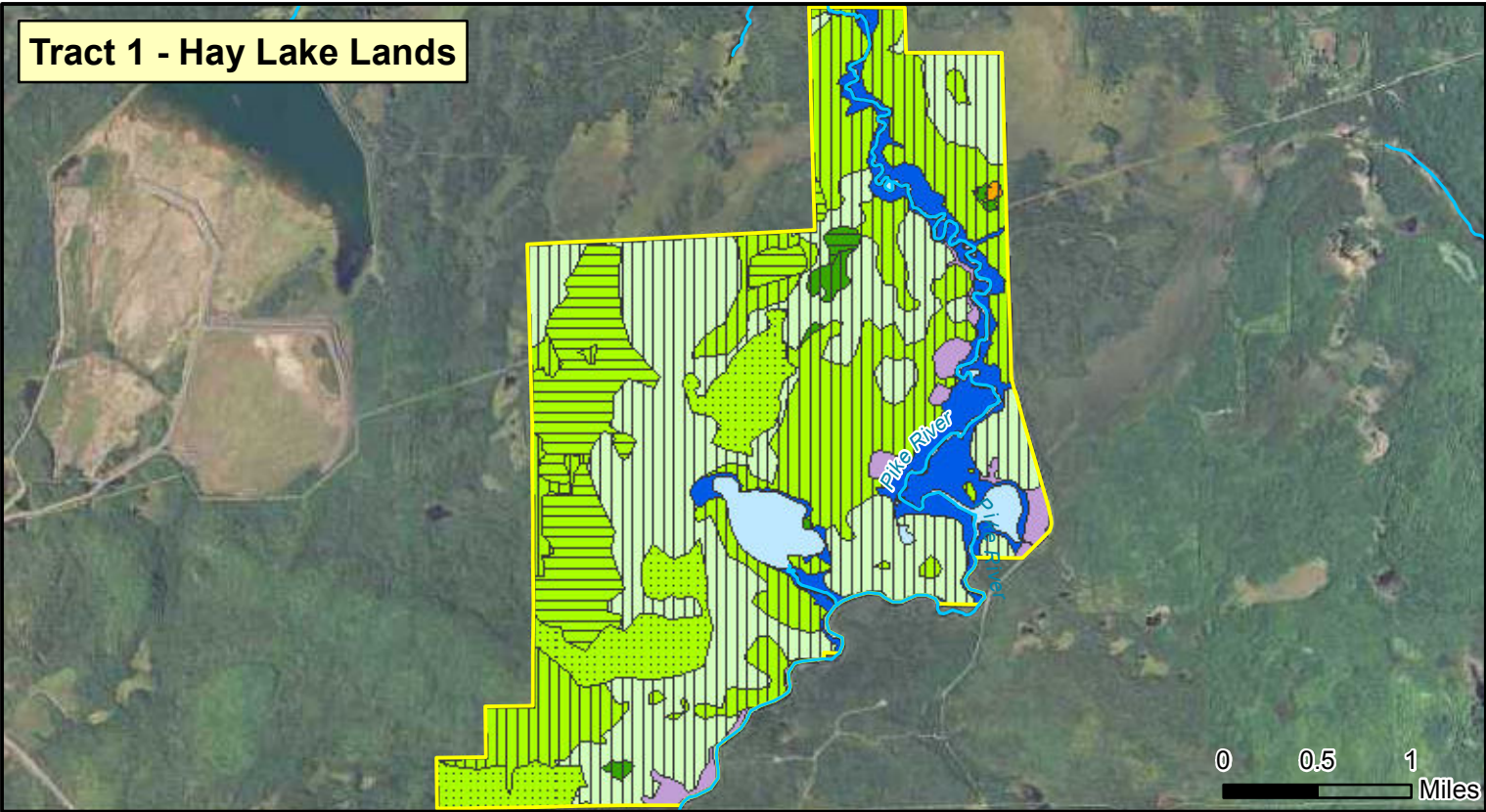


Figure 9
Management Indicator Habitat Types
and Age Classes - Federal Lands
 Biological Evaluation for the NorthMet Project and Land Exchange
 St. Louis County, Minnesota



Federal Lands	Open Water	Mature
Non-federal Lands	Other Lowland Emergent	Immature
Management Indicator Habitat	Other Lowland Shrub	Young
Upland Forest	Other Upland Grass	N/A
Upland Coniferous Forest	N/A	
Lowland Black Spruce		

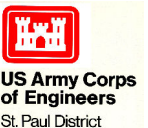


Figure 10
Management Indicator Habitat Types and Age Classes -
Hay Lake Lands, Lake County Lands, and Wolf Lands 1 and 2
 Biological Evaluation for the NorthMet Project and Land Exchange
 St. Louis County, Minnesota

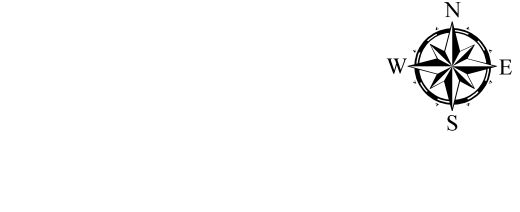
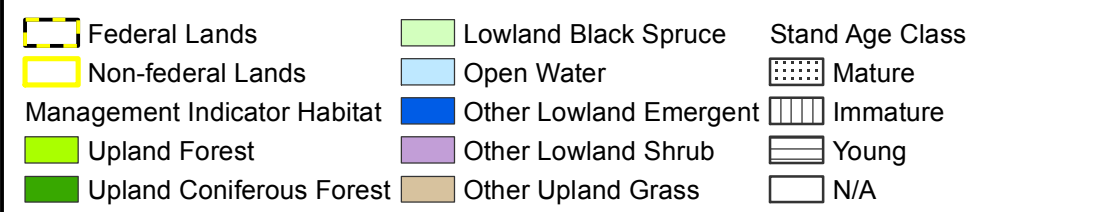
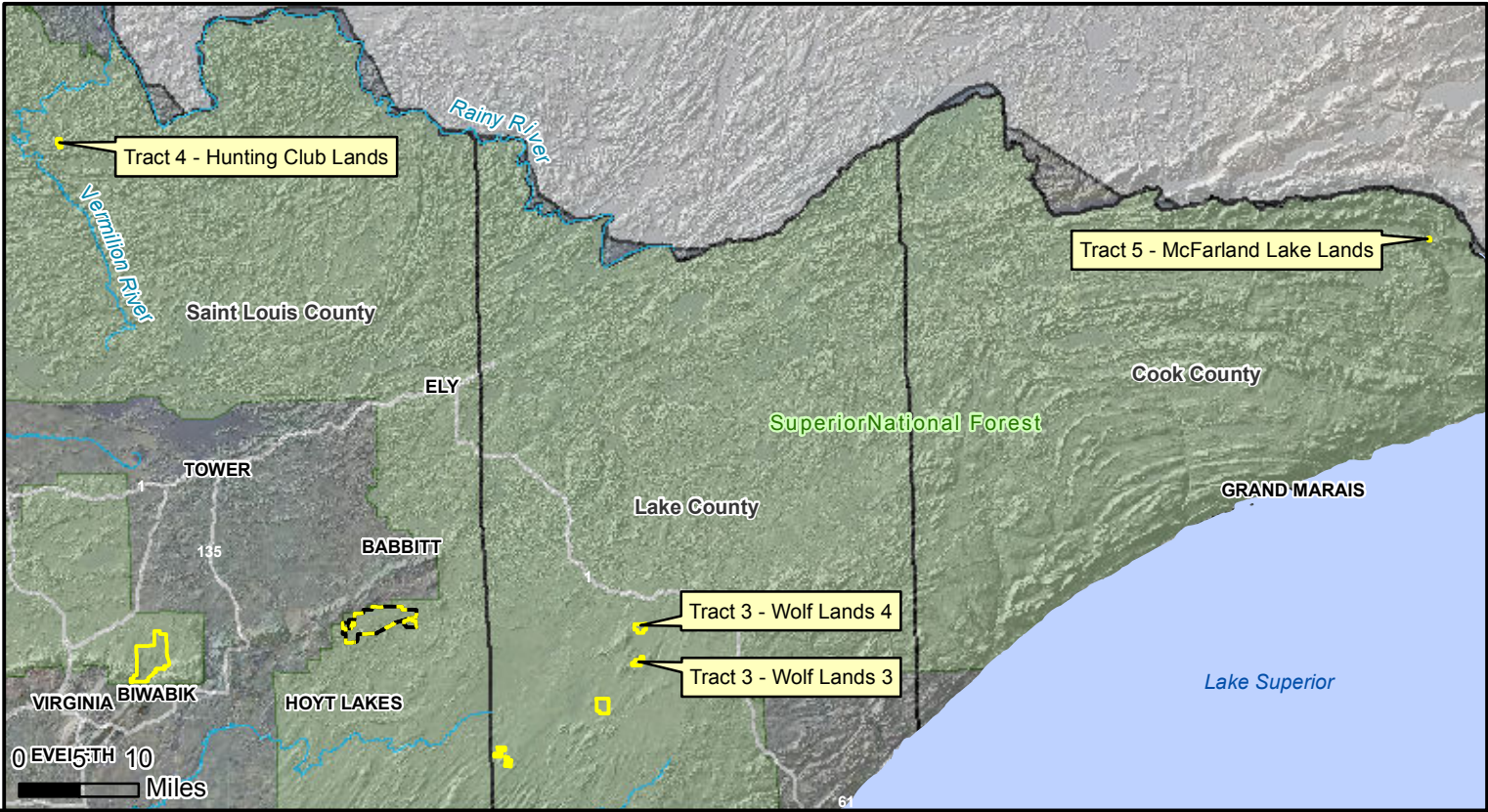
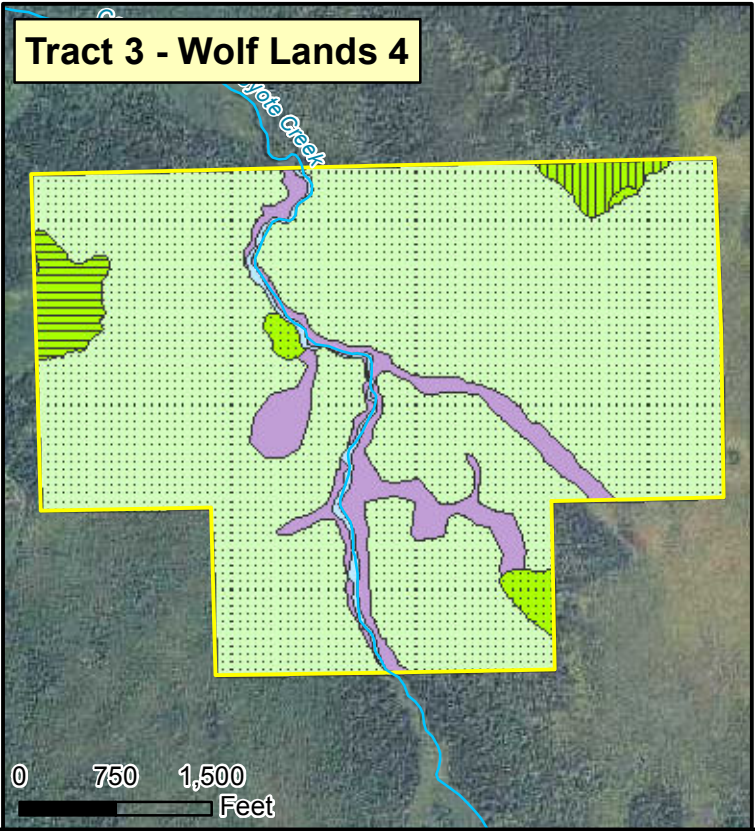
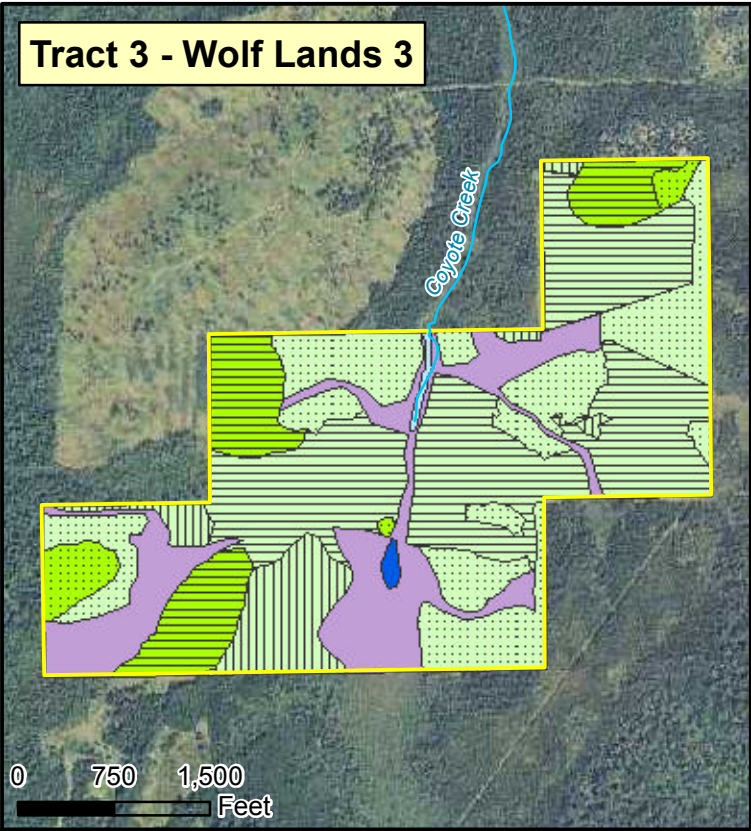
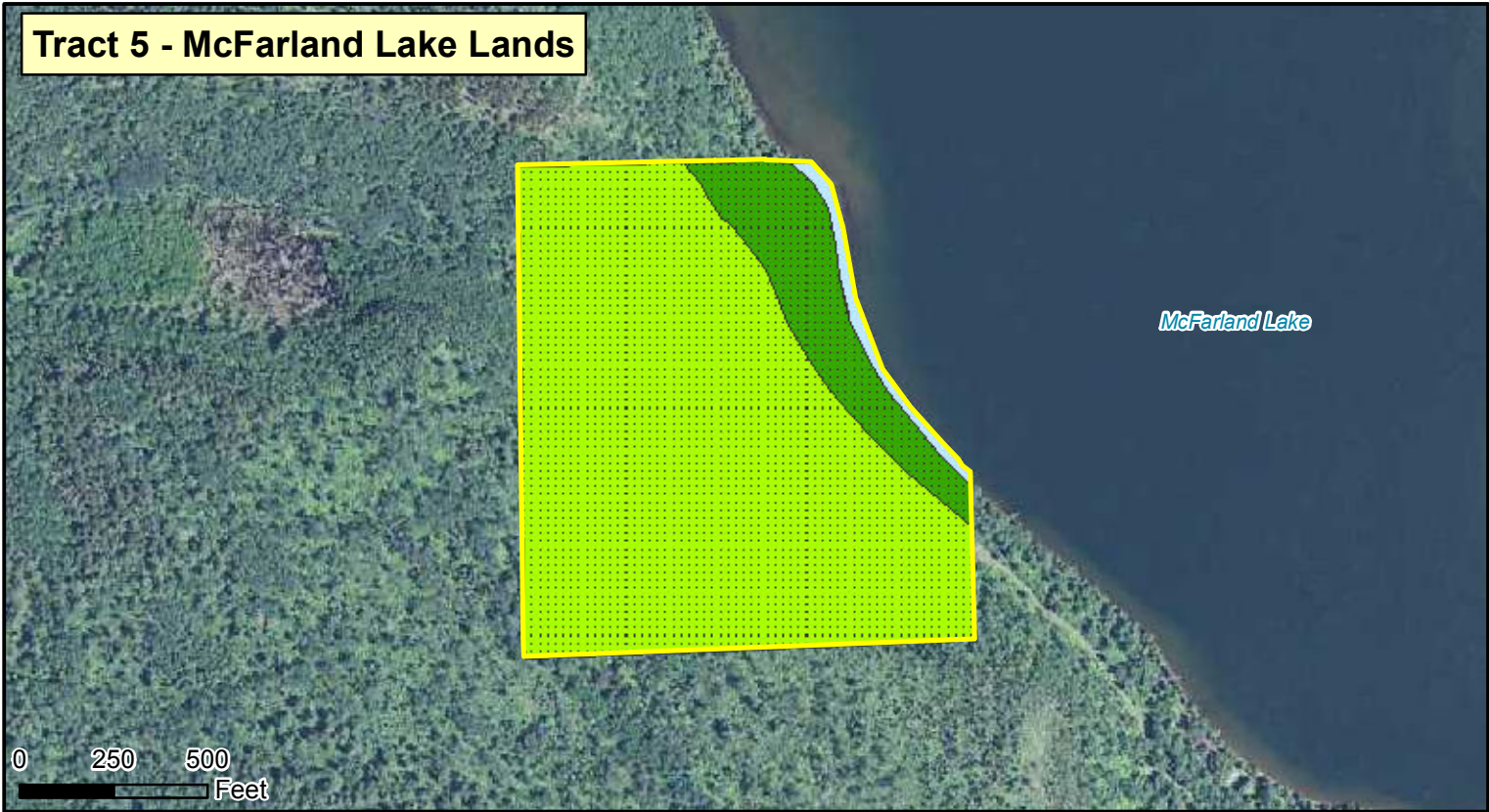
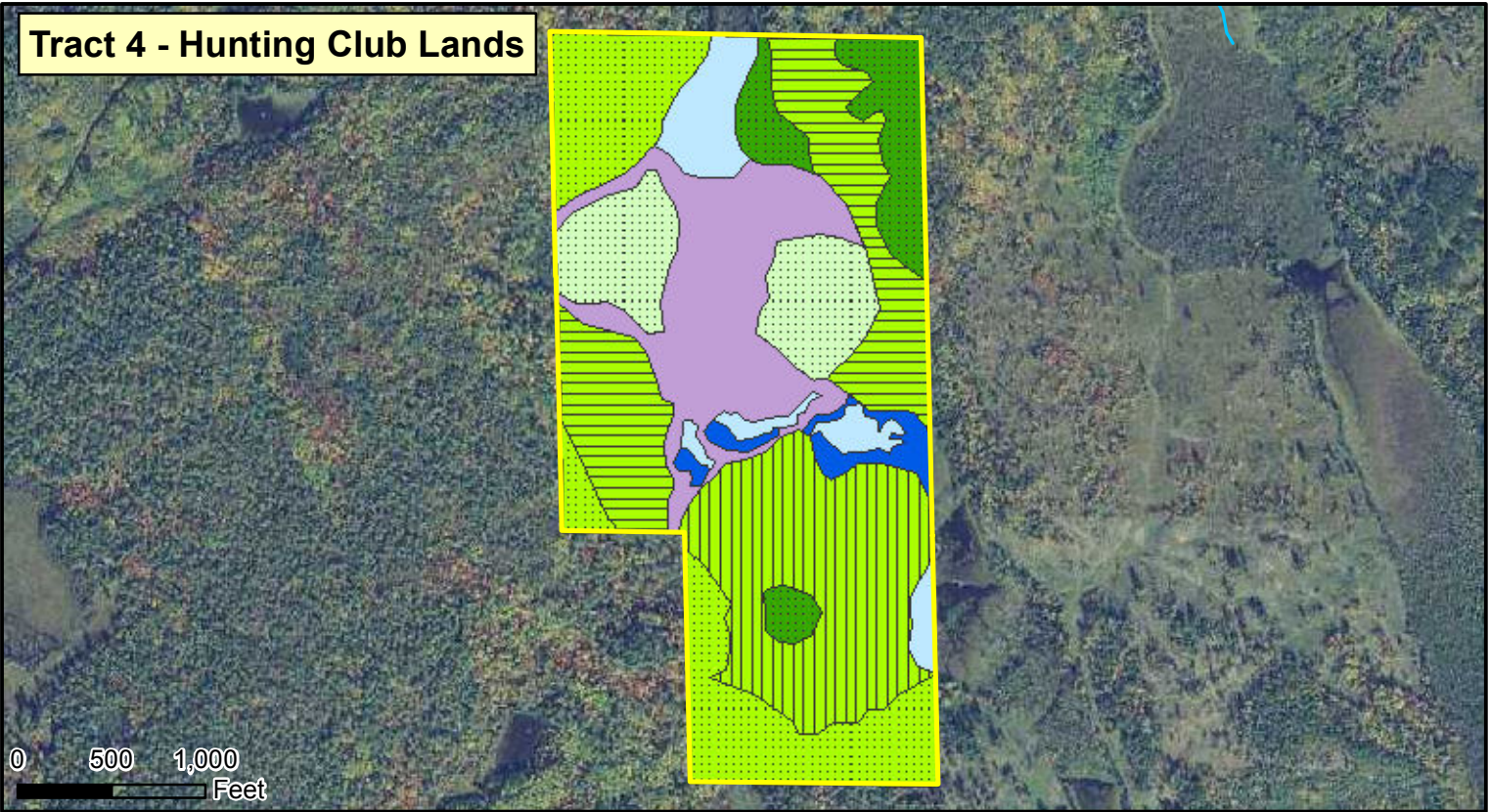
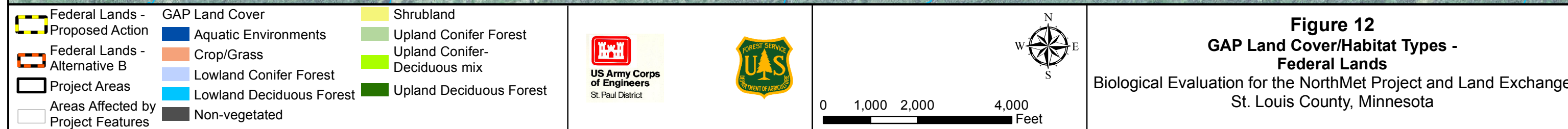
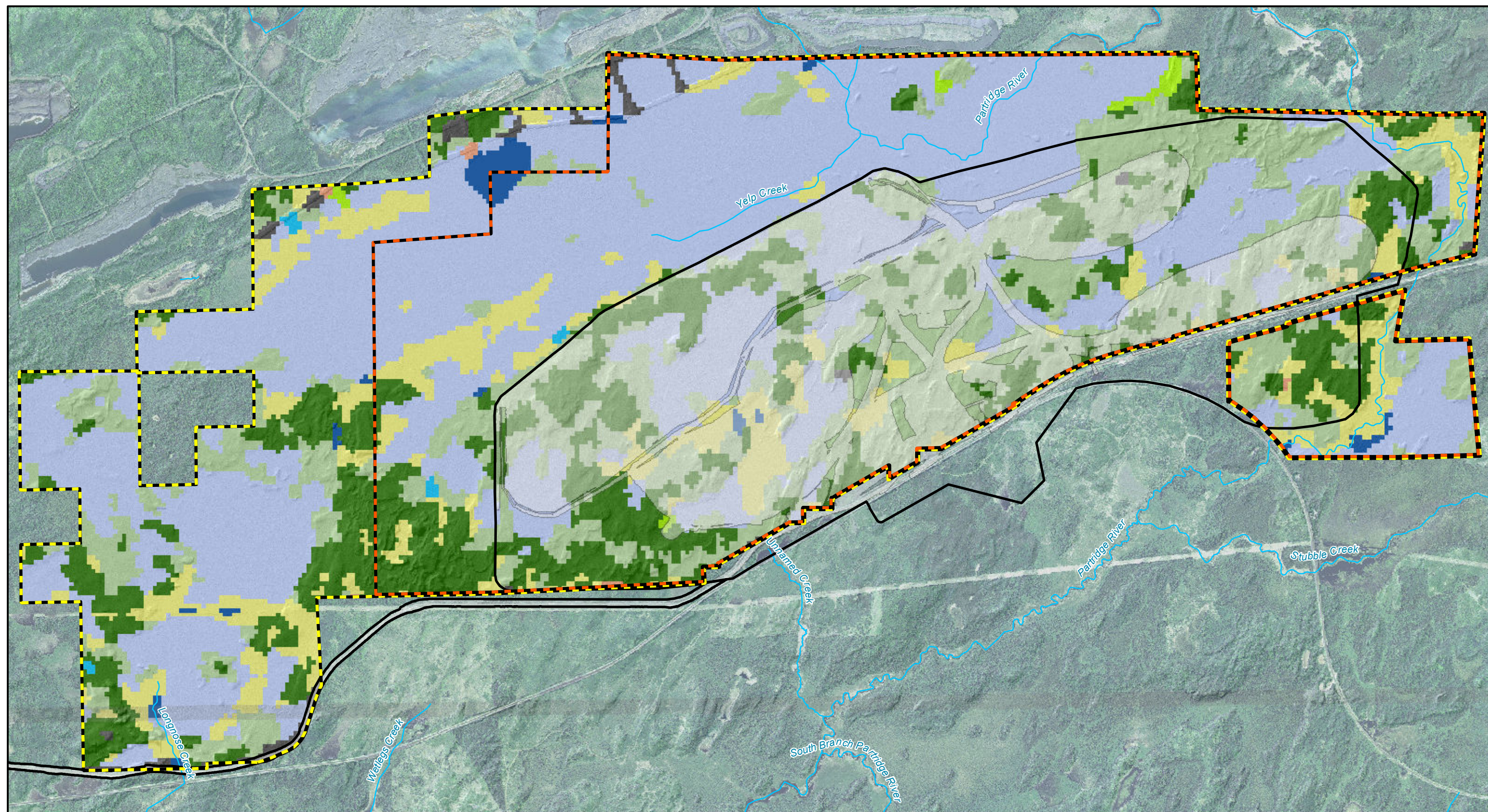


Figure 11
Management Indicator Habitat Types and Age Classes -
Hunting Club Lands, Mc Farland Lake Lands,
and Wolf Lands 3 and 4
 Biological Evaluation for the NorthMet Project and Land Exchange
 St. Louis County, Minnesota



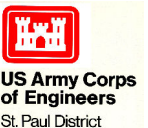
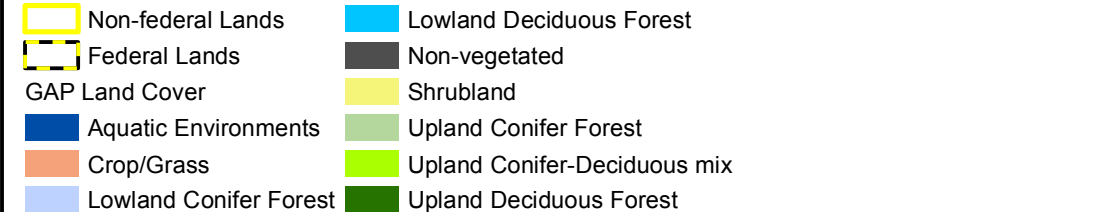
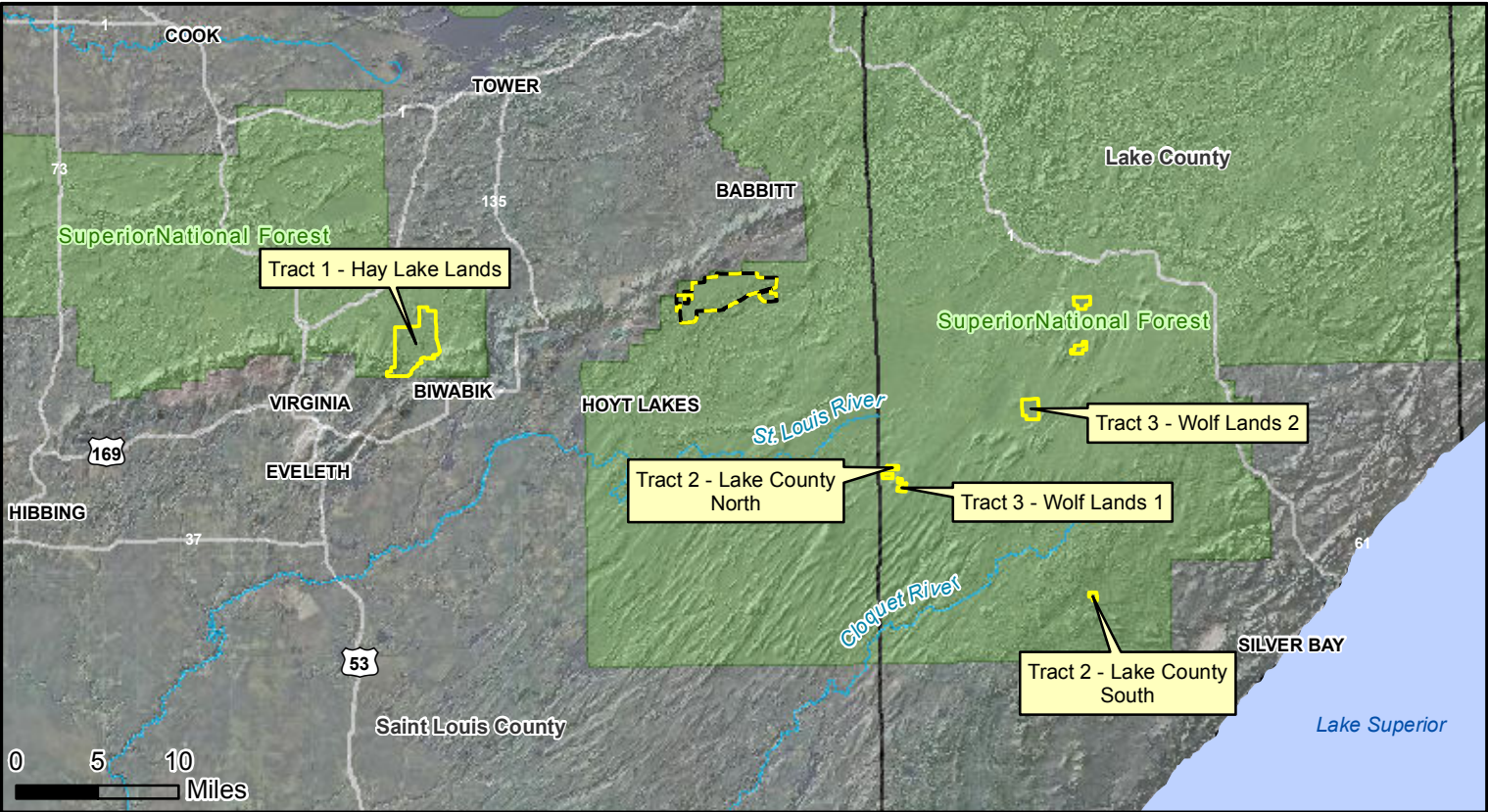
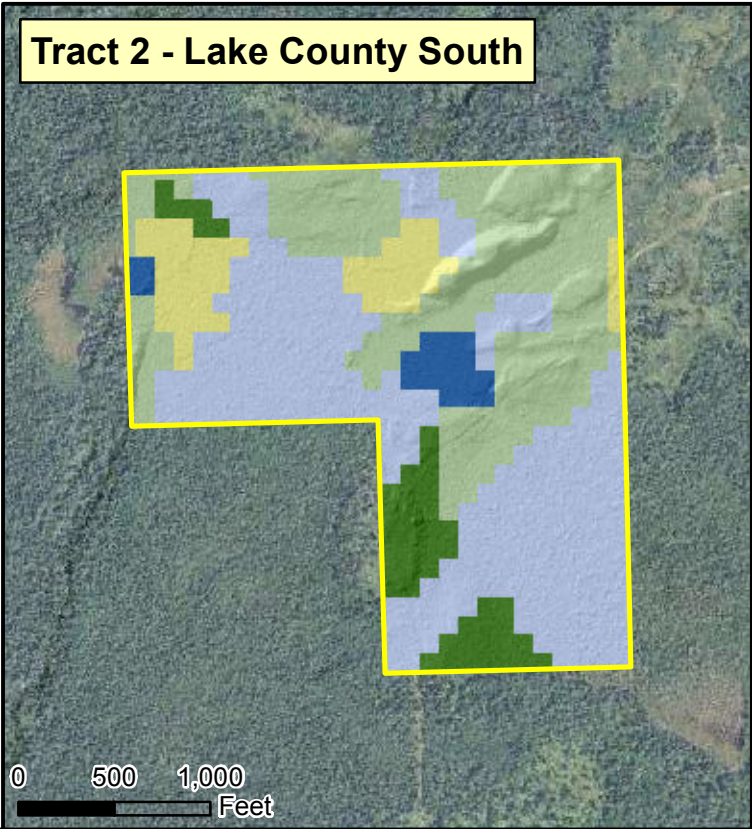
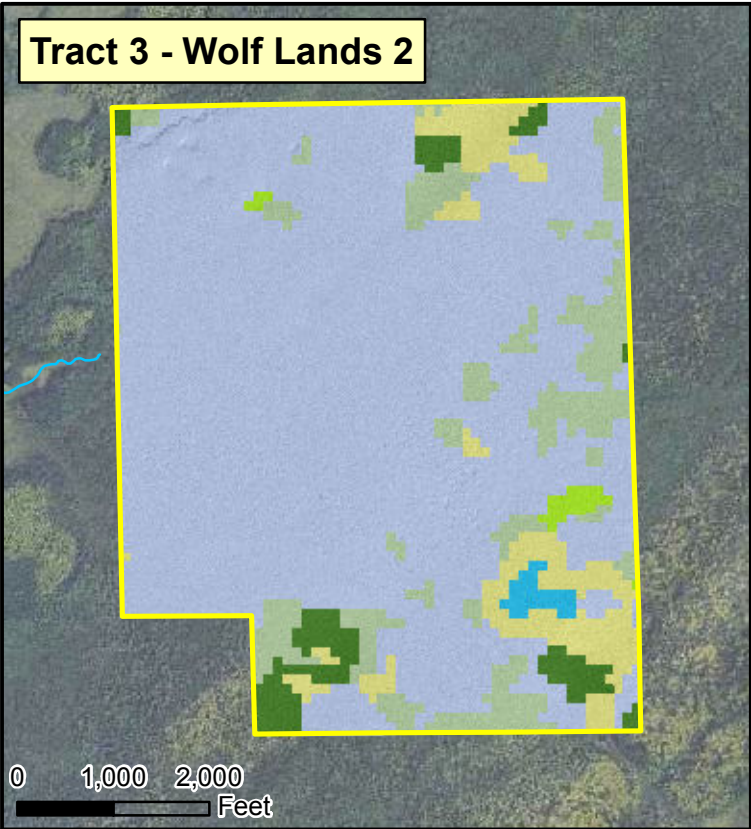
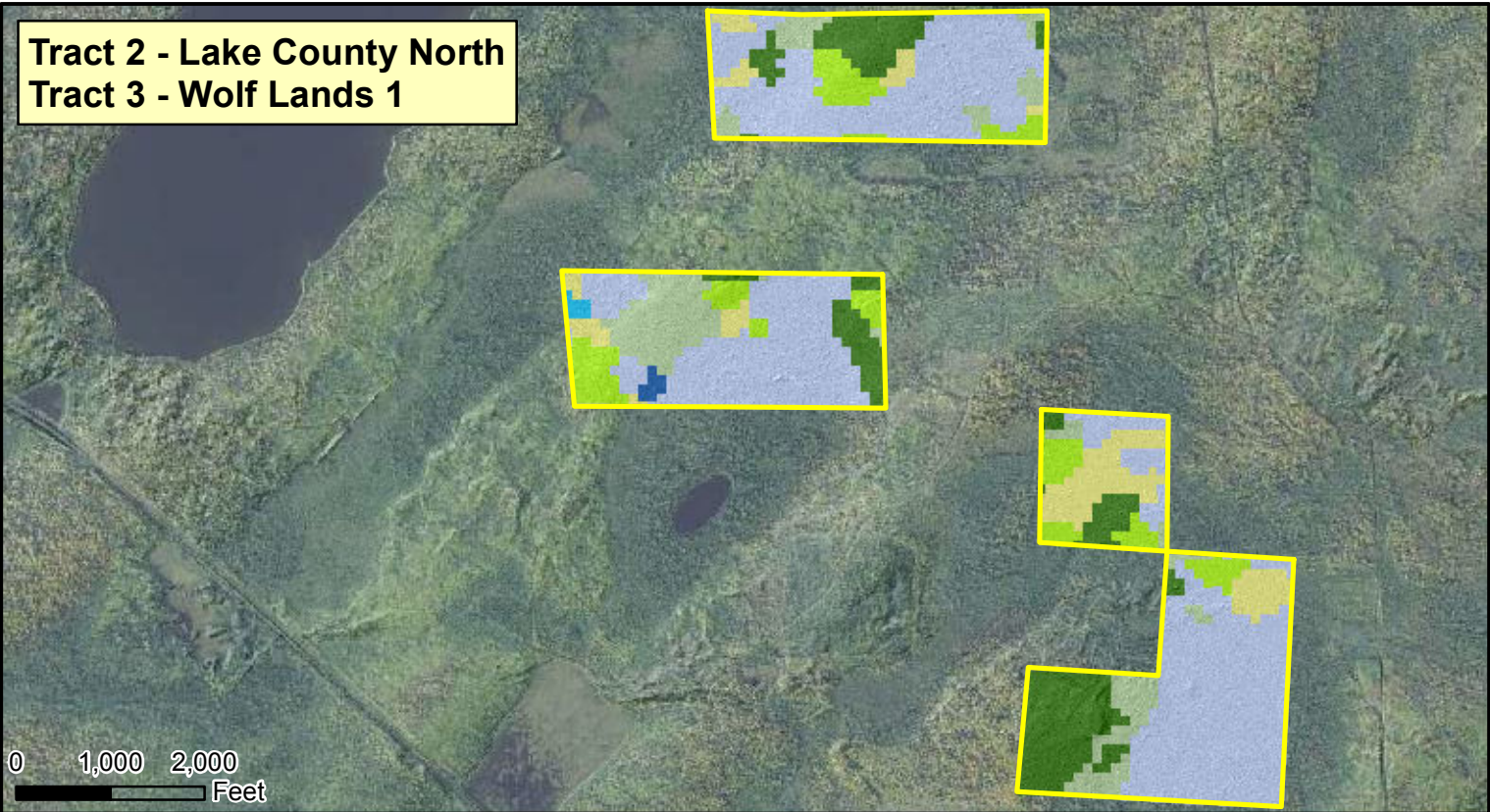
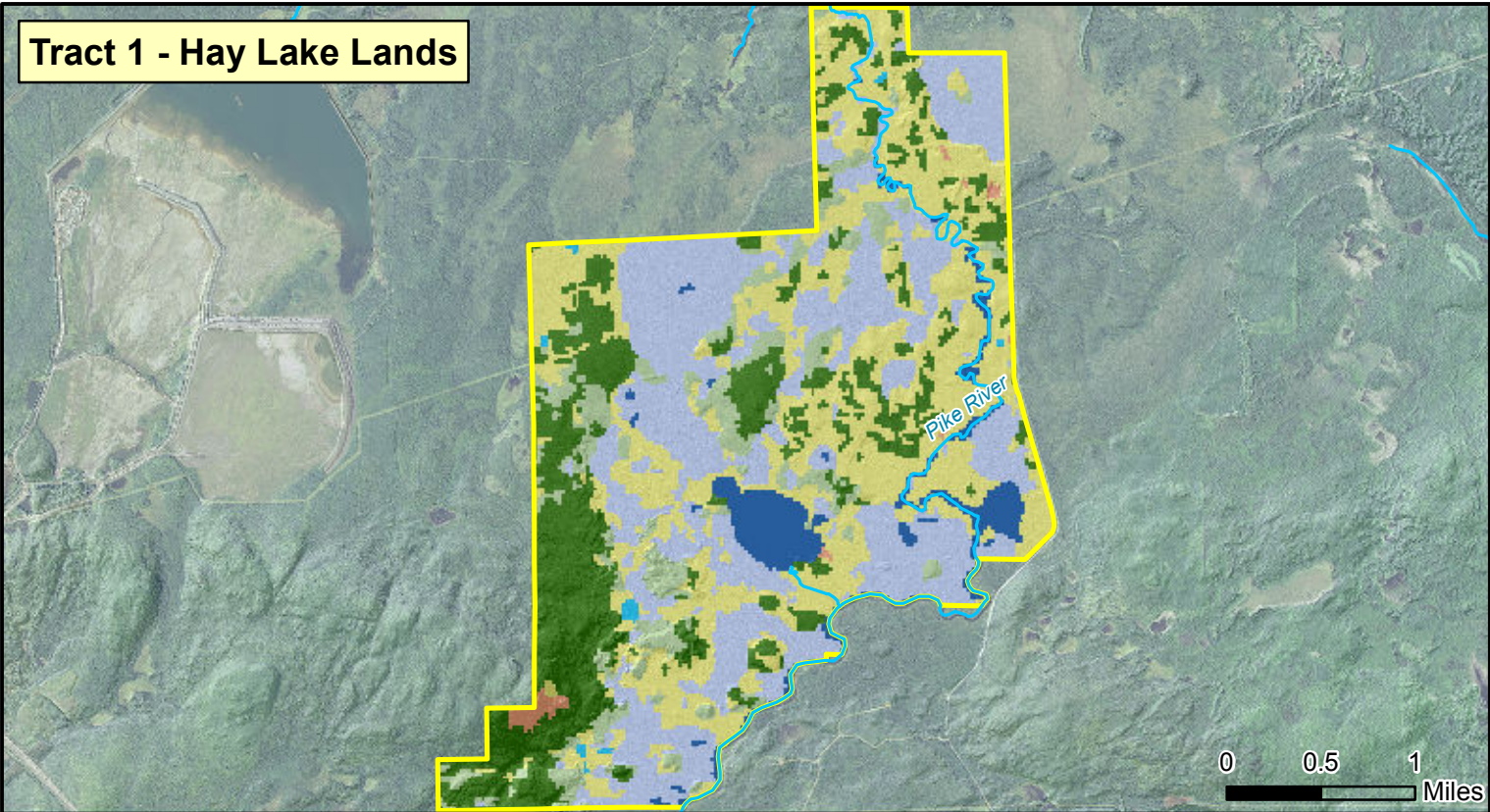


Figure 13
GAP Land Cover/Habitat Types -
Hay Lake Lands, Lake County Lands, and Wolf Lands 1 and 2
Biological Evaluation for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

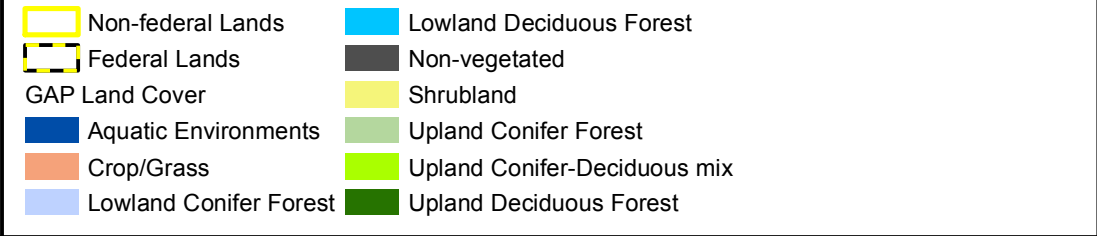
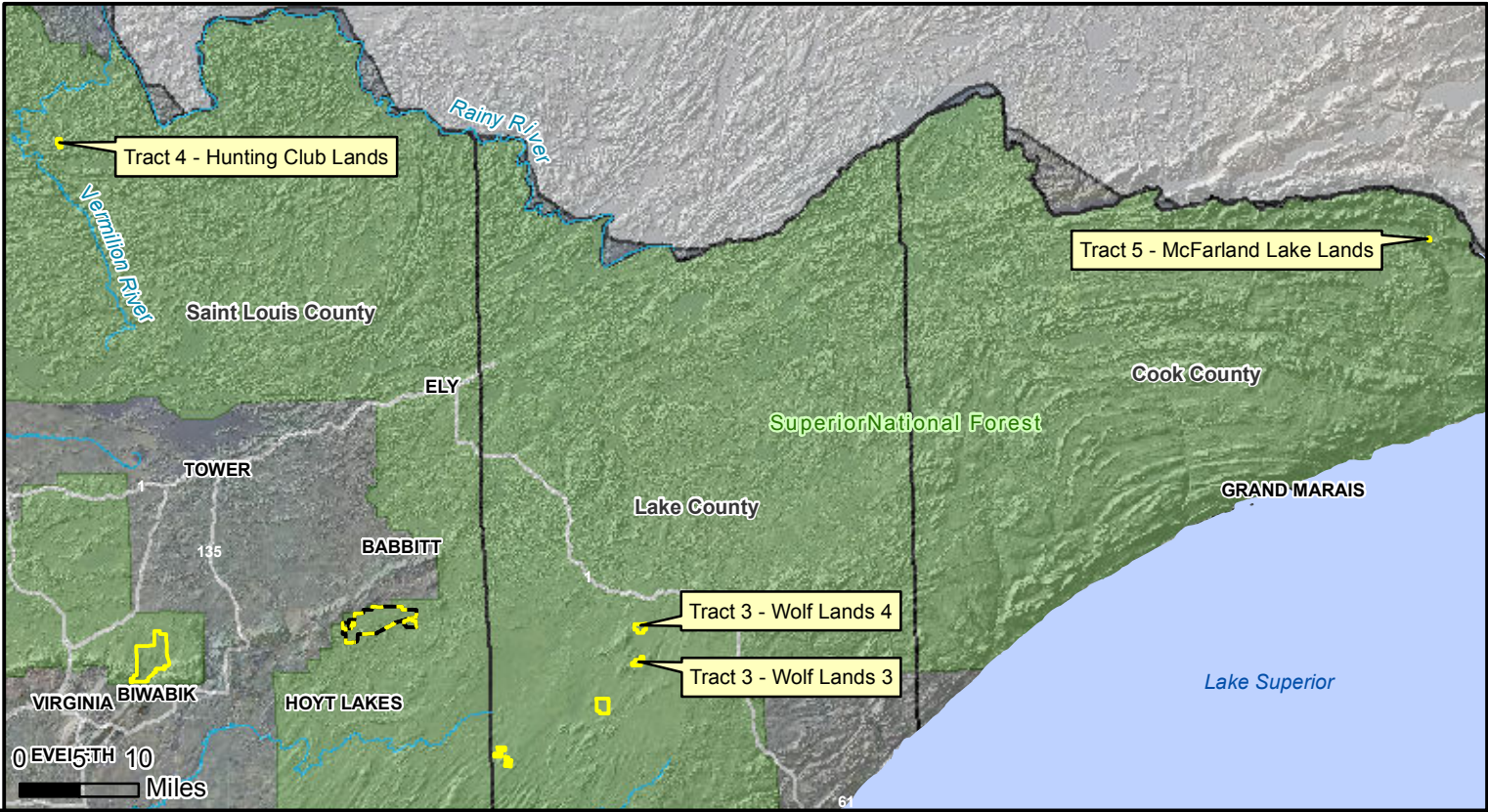
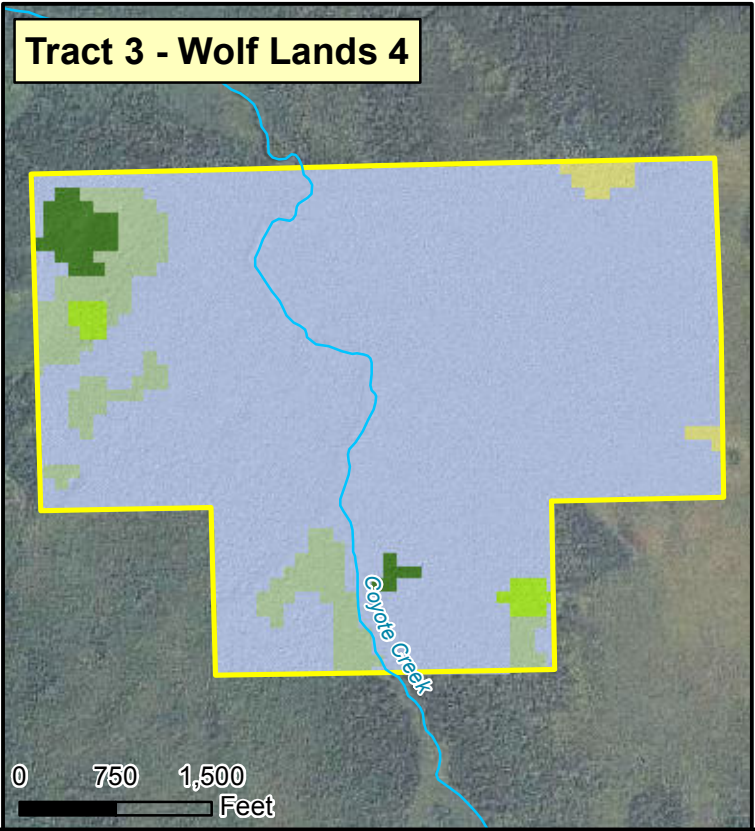
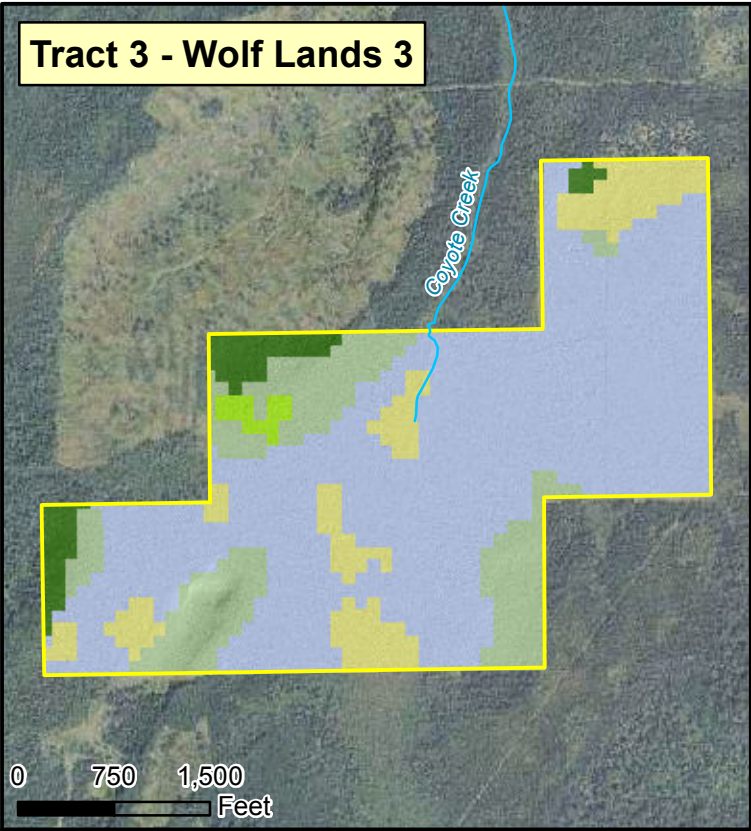
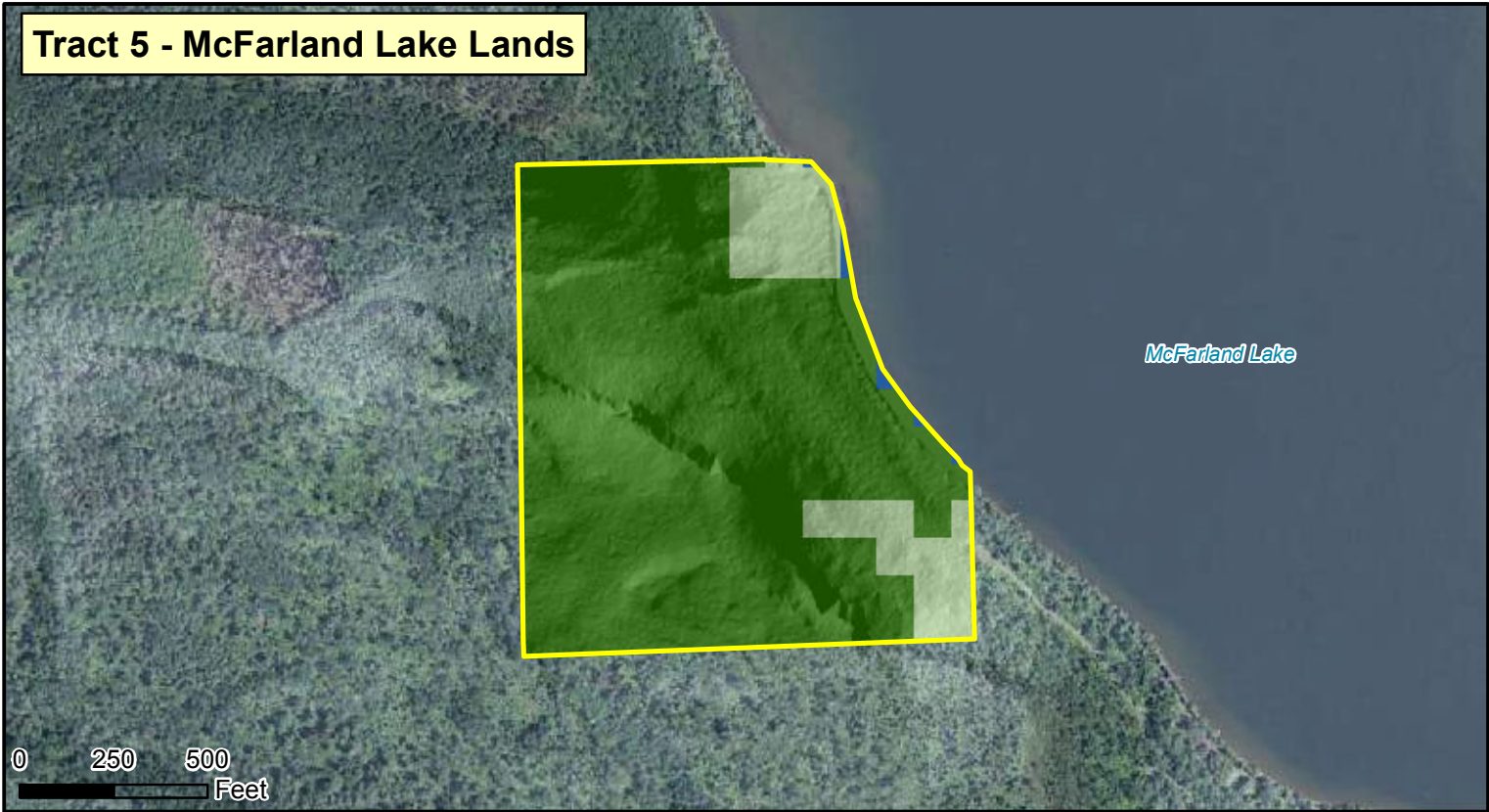
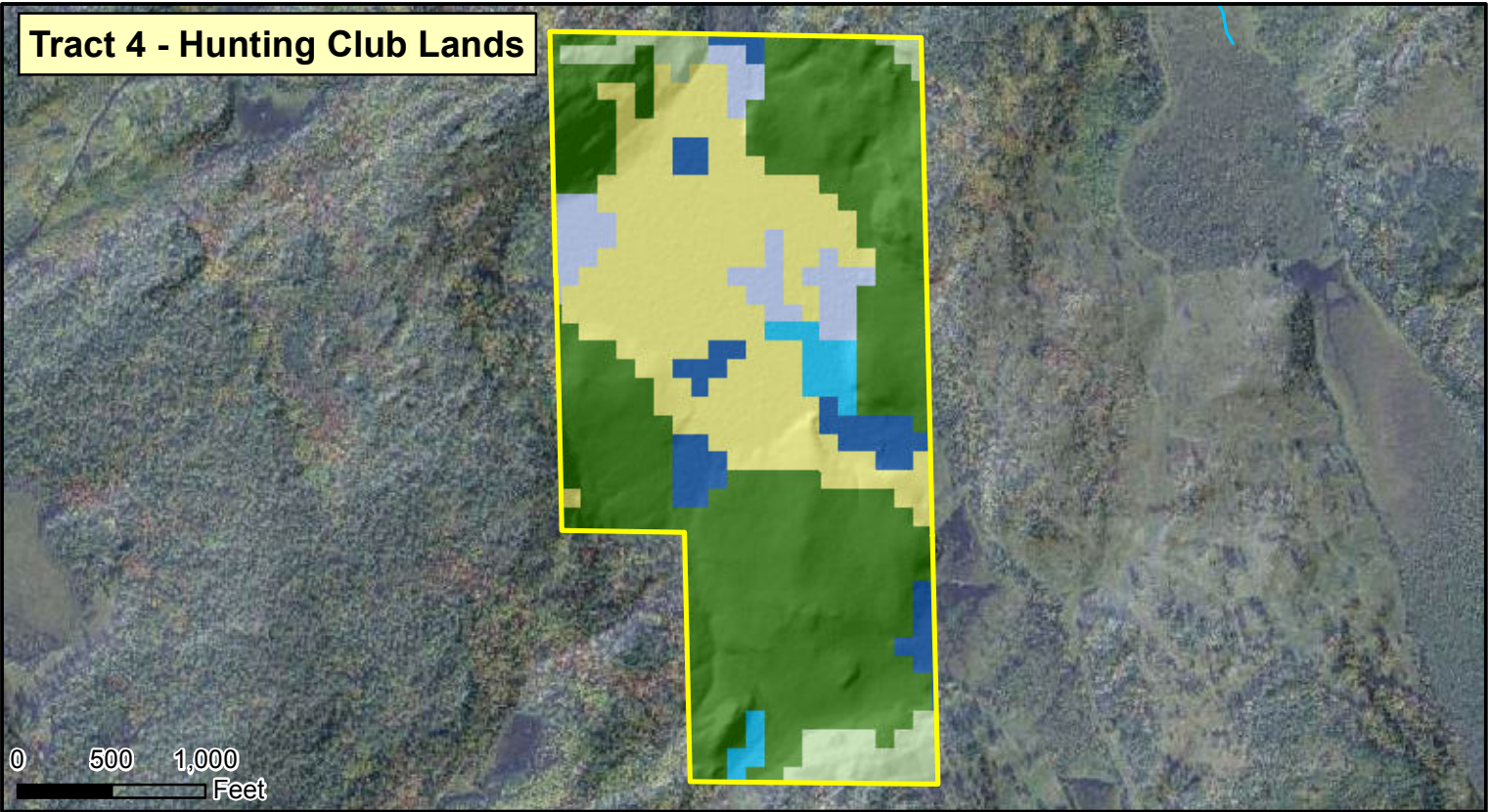
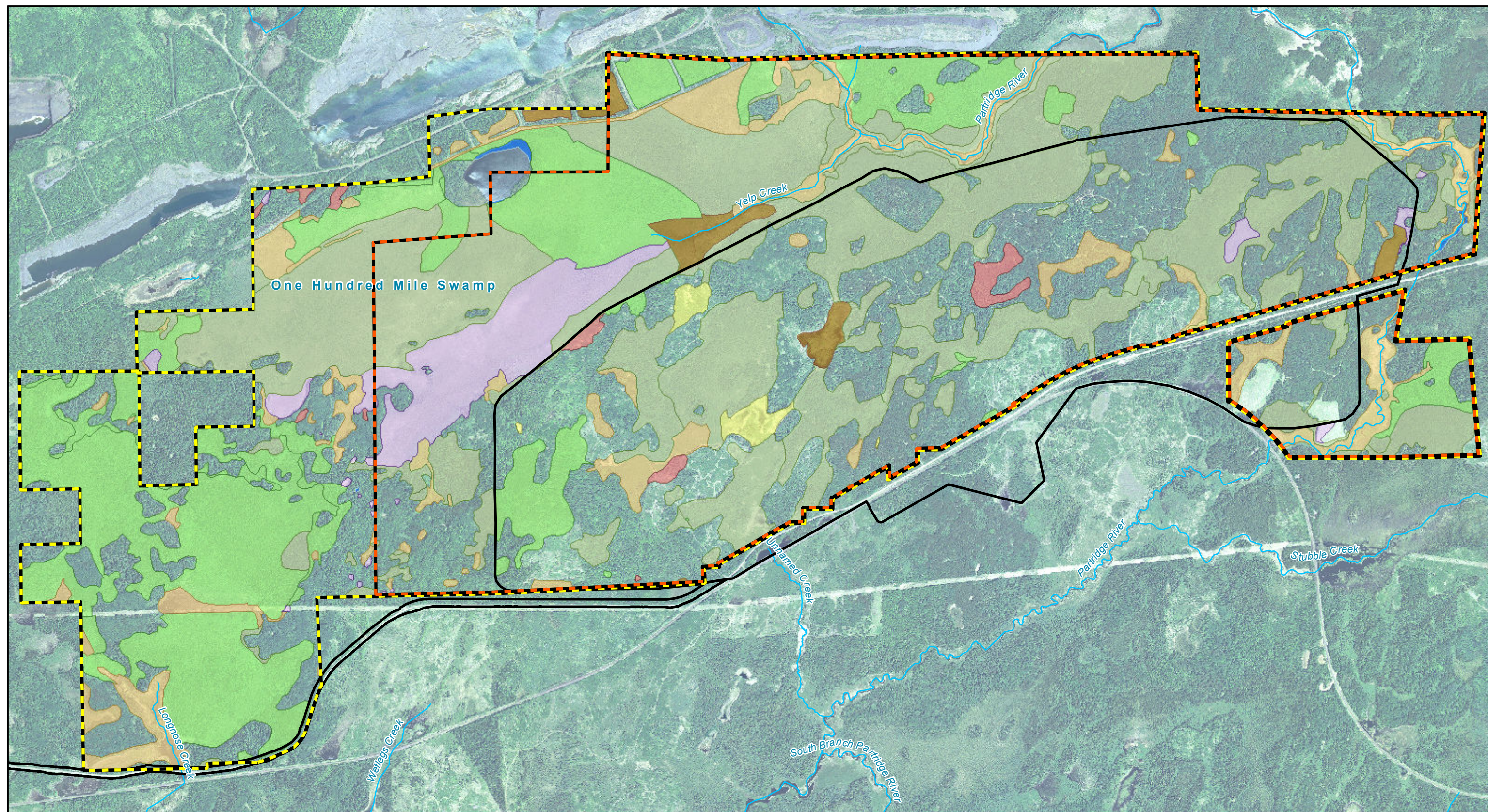


Figure 14
GAP Land Cover/Habitat Types - Hunting Club Lands, McFarland Lake Lands, and Wolf Lands 3 and 4
 Biological Evaluation for the NorthMet Project and Land Exchange
 St. Louis County, Minnesota



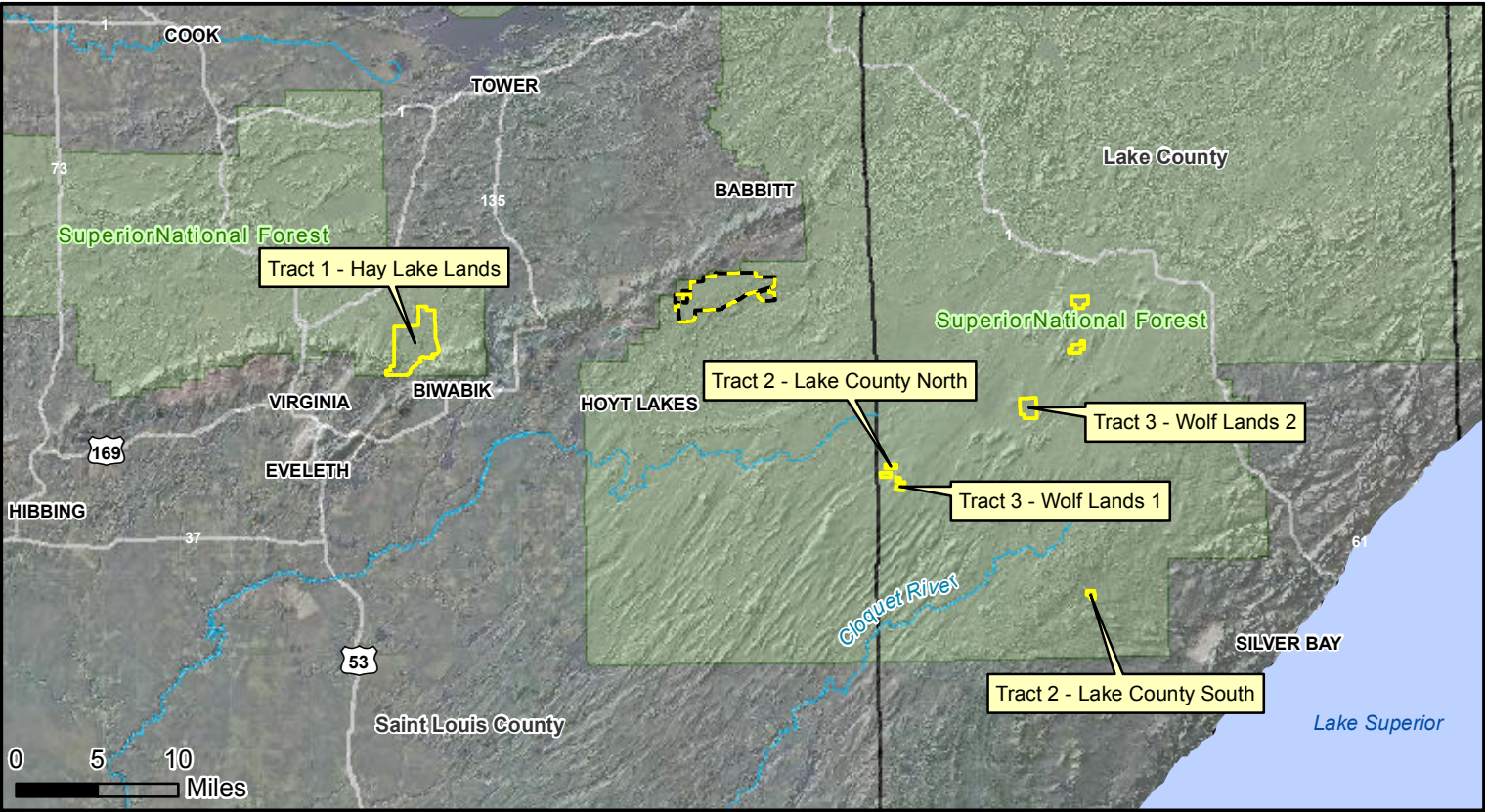
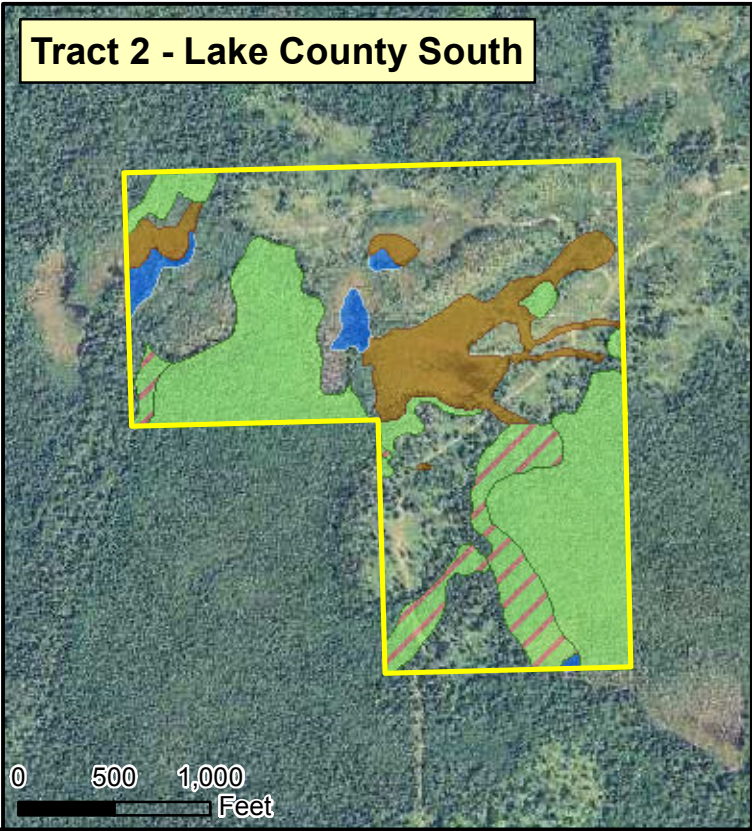
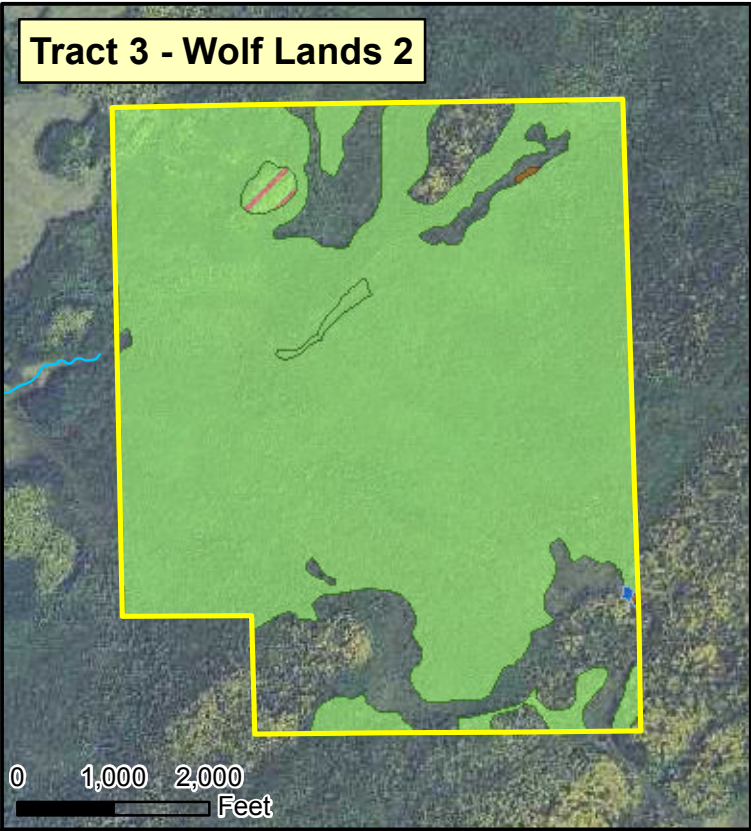
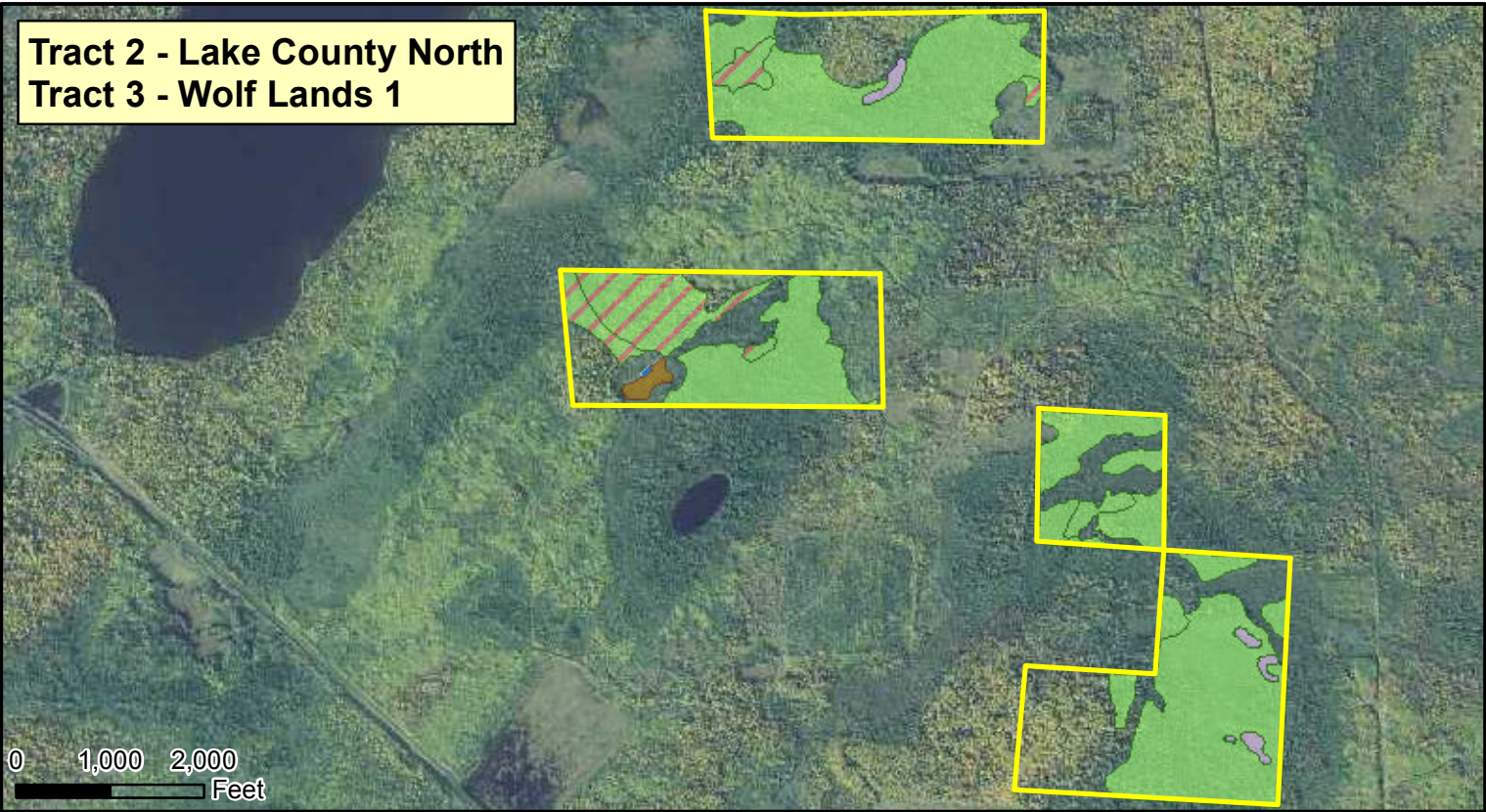
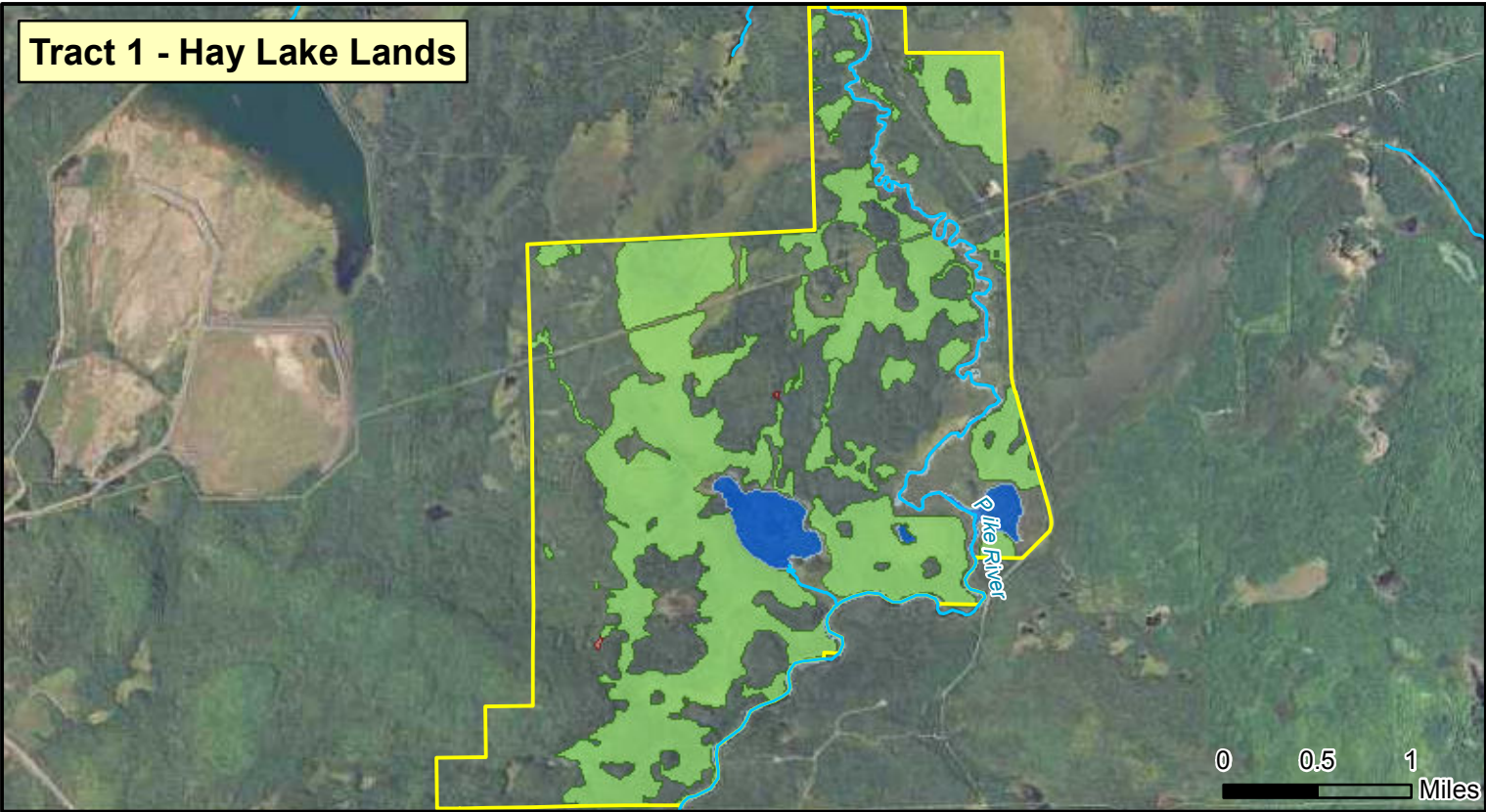
- | | | |
|---|---------------------------|--|
| Federal Lands - Proposed Action | Coniferous bog | Open water (Shallow, open water & lakes) |
| Federal Lands - Alternative B | Coniferous swamp | |
| Project Areas | Deep marsh; Shallow marsh | Open bog |
| Eggers & Reed Wetland Types | Hardwood swamp | Sedge meadow; Wet meadow |
| Shrub Swamps (Alder thickets & Shrub-carrs) | | |



0 1,000 2,000 4,000 Feet



Figure 15
Wetlands - Federal Lands
 Biological Evaluation for the NorthMet Project and Land Exchange
 St. Louis County, Minnesota



- | | |
|---|---|
| <ul style="list-style-type: none"> Federal Lands Non-federal Lands Eggers & Reed Wetland Types <ul style="list-style-type: none"> Shrub Swamps (Alder thickets & Shrub-carrs) Coniferous bog | <ul style="list-style-type: none"> Coniferous swamp Deep marsh; Shallow marsh Hardwood swamp Hardwood/Coniferous swamp Open water (Shallow, open water & lakes) Open bog Sedge meadow; Wet meadow |
|---|---|



Figure 16
Wetlands - Hay Lake Lands, Lake County Lands, and Wolf Lands 1 and 2
 Biological Evaluation for the NorthMet Project and Land Exchange
 St. Louis County, Minnesota

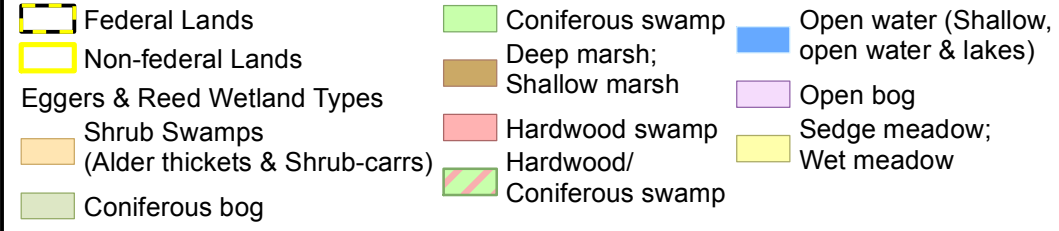
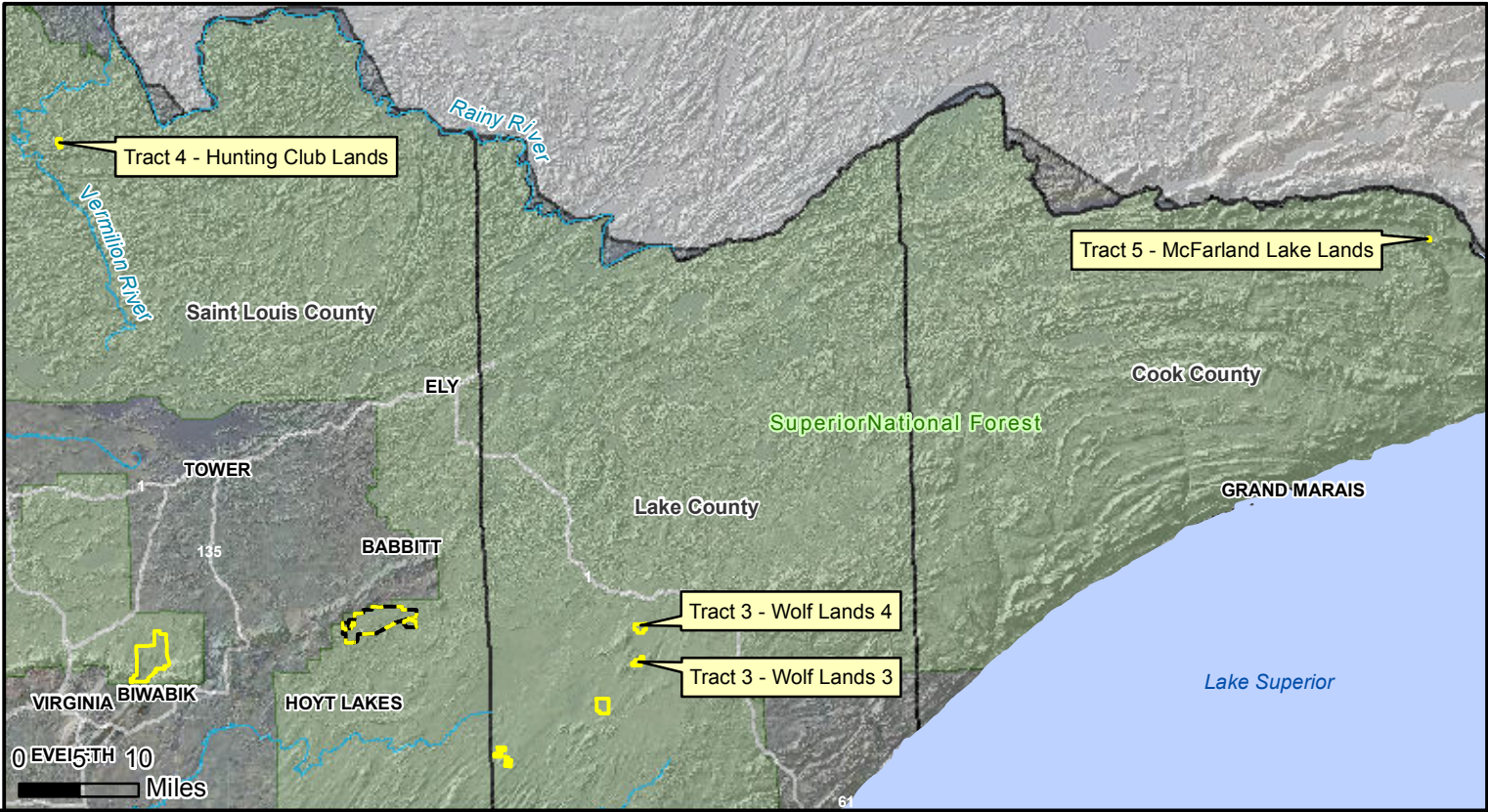
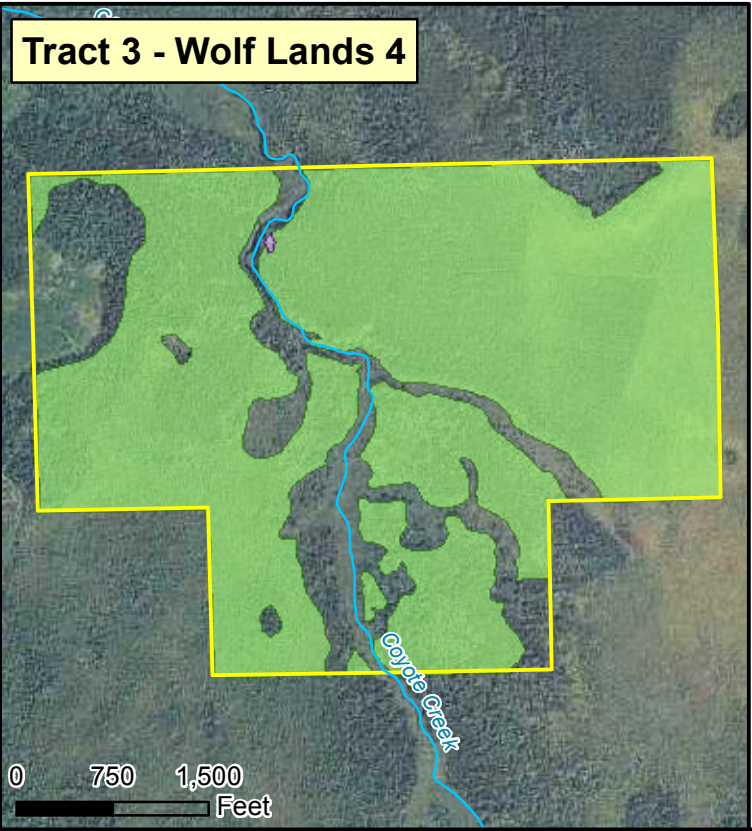
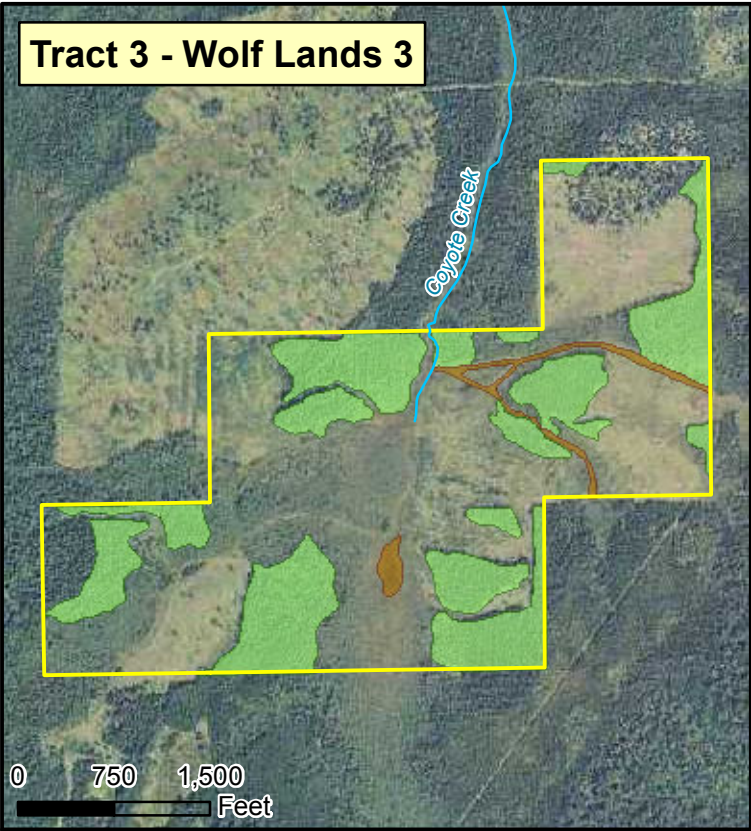
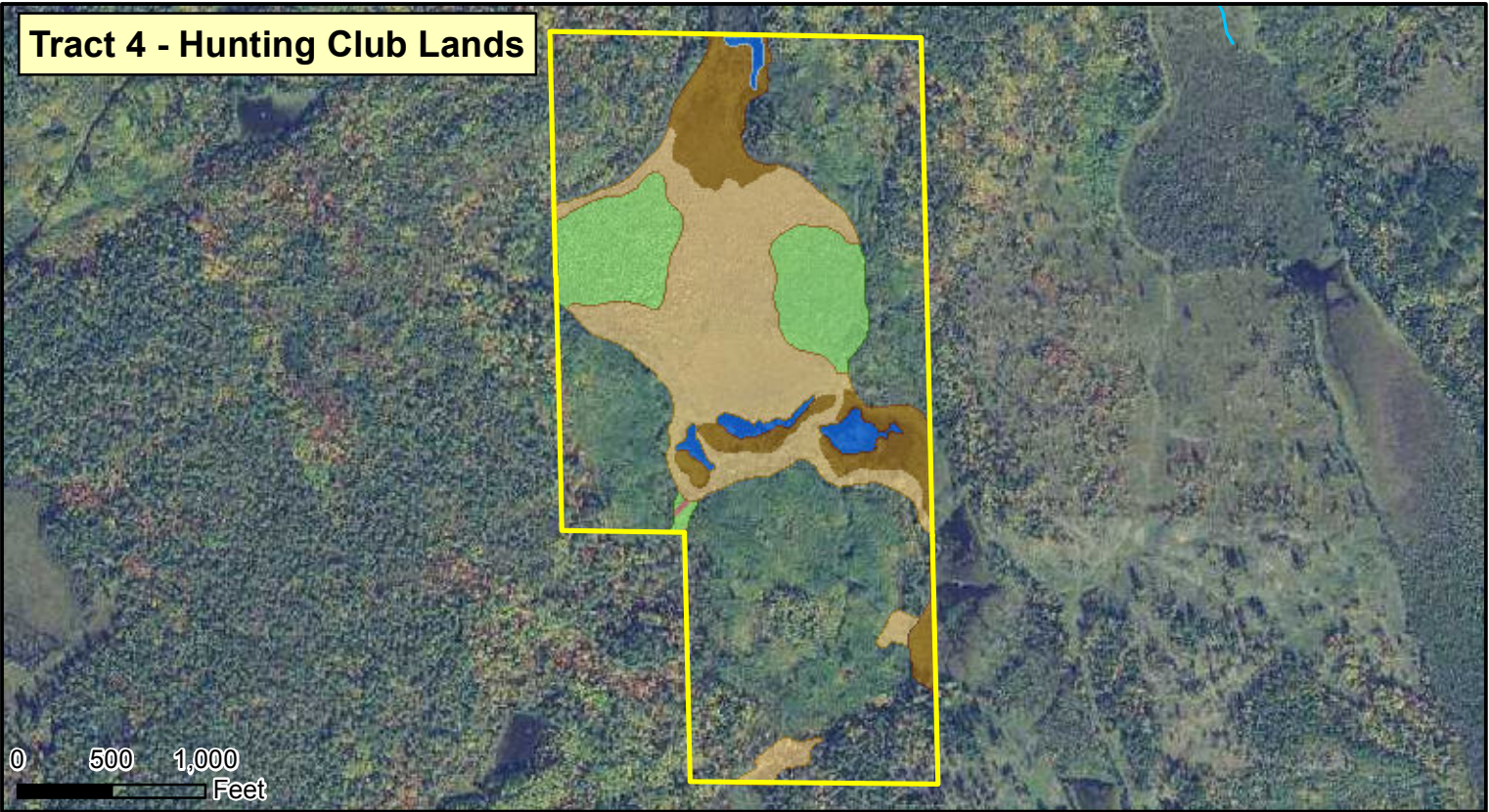


Figure 17
Wetlands - Hunting Club Lands, McFarland Lake Lands, and Wolf Lands 3 and 4
Biological Evaluation for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

Table 5
GAP Cover Type and Management Indicator Habitat on Federal and Non-federal Lands

Cover Type	Federal Lands	Non-federal Lands									Net Gain (Loss) to Forest Service after Land Exchange ¹
		Hay Lake	Hunting Club	Lake North	Lake South	McFarland Lake	Wolf Lands 1	Wolf Lands 2	Wolf Lands 3	Wolf Lands 4	
MDNR GAP Types											
Aquatic	60	251	10	2	4	0	0	0	0	0	207
Disturbed	64	0	0	0	0	0	0	0	0	0	(64)
Cropland/grassland	6	32	0	0	0	0	0	0	0	0	26
Shrubland	646	1,665	45	28	11	0	7	54	32	4	1,200
Lowland coniferous forest	2,979	1,524	9	133	53	0	75	586	184	357	(57)
Lowland deciduous forest	10	17	4	1	0	0	0	6	0	0	18
Upland coniferous forest	1,619	437	8	33	39	4	13	87	46	32	(920)
Upland deciduous forest	1,092	1,000	85	34	10	27	27	30	12	8	141
Upland mixed coniferous/deciduous forest	21	0	0	34	0	0	4	6	3	4	31
Management Indicator Habitat and other Forest Service Habitat Types											
MIH 1	1,330	2,366	89	49	2	26	44	57	41	20	1,364
MIH 5	1,252	54	13	1	0	4	0	8	0	0	(1,172)
MIH 9	3,060	1,818	17	194	46	0	72	627	186	349	249
MIH 14	0	206	10	1	3	1	0	1	1	4	227
Lowland Shrub	492	113	27	21	6	0	10	76	49	31	(160)
Lowland Emergent	186	365	4	0	16	0	0	0	1	0	201
Upland Grass	0	0	0	0	43	0	0	0	0	0	43
Management Indicator Habitat Age Class											
Young	271	534	27	24	43	0	2	8	130	10	507
Immature	1,539	3,260	33	75	1	0	76	69	22	5	2,001
Mature	3,854	460	60	145	48	30	38	615	75	354	(2,029)

¹ Totals may differ from actual sums due to rounding.
 Sources: MDNR (2006), USDA Forest Service (2010a).

Table 6
Management Indicator Habitat and Age Classes on Federal and Non-federal Lands

Management Indicator Habitat and Age Class	Federal Lands - Existing Conditions (acres)		Direct Project Impacts – Federal Lands (acres) ¹	Non-federal Lands - Existing Conditions (acres)		Net Gain (Loss) to Forest Service after Land Exchange	
	Proposed Action	Alternative B		Proposed Action (All Lands)	Alternative B (Hay Lake Lands only)	Proposed Action ²	Alternative B ³
MIH 1	1,330	954	532	2,695	2,366	1,365	1,412
Young	233	233	144	607	519	374	286
Immature	540	395	231	1,497	1,387	957	992
Mature	557	326	158	591	460	34	134
MIH 5	1,252	1,139	505	80	54	(1,173)	(1,085)
Young	38	38	38	15	15	(23)	(23)
Immature	979	915	443	40	40	(940)	(876)
Mature	235	186	24	26	0	(210)	(186)
MIH 9	3,060	2,079	482	3,309	1,818	249	(261)
Young	0	0	0	113	0	113	0
Immature	20	16	0	1,988	1,818	1,968	1,802
Mature	3,040	2,063	482	1,208	0	(1,832)	(2,063)
MIH 14	0	0	0	227	206	227	206
N/A ⁴	175	80	2	4	4	(171)	(76)
Other Lowland Emergent ⁴	185	115	11	386	365	200	250
Other Lowland Shrub ⁴	492	385	141	332	113	(160)	(272)
Other Upland Grass ⁴	0	0	0	43	0	43	0
Totals⁵	6,495	4,753	1,673	7,075	4,926	580	173
MIH by age class						0	0
Young	271	271	181	778	534	507	263
Immature	1,539	1,326	673	3,540	3,260	2,001	1,934
Mature	3,854	2,575	665	1,825	460	(2,029)	(2,115)

¹ Acres of direct impacts from the Project are the same for the Proposed Action and Alternative B. The area of direct impacts on the federal lands includes portions of the Mine Site and the Dunka Road and Utility Corridor.

² The Proposed Action includes a land exchange of federal lands (6,495 acres) and non-federal lands (7,705 acres).

³ Alternative B includes a land exchange of federal lands (4,753 acres) and non-federal lands (Hay Lake Lands; 4,926 acres).

⁴ MIH type was not provided (N/A) or age class was not defined.

⁵ Totals may differ from actual sums due to rounding.

Source: USDA Forest Service (2010a).

Table 7
GAP Cover Types on Federal and Non-federal Lands

GAP Cover Types	Federal Lands - Existing Conditions (acres)		Direct Project Impacts – Federal Lands (acres) ¹	Non-federal Lands - Existing Conditions (acres)		Net Gain (Loss) to Forest Service after Land Exchange	
	Proposed Action	Alternative B		Proposed Action (All Lands)	Alternative B (Hay Lake Lands only)	Proposed Action ²	Alternative B ³
Aquatic	60	26	4	267	251	207	225
Disturbed	64	29	16	0	0	(64)	(29)
Cropland/grassland	6	2	0	32	32	26	30
Shrubland	646	437	127	1,846	1,665	1,200	1,228
Lowland coniferous forest	2,979	2,065	437	2,921	1,524	(58)	(541)
Lowland deciduous forest	10	5	0	28	17	18	12
Upland coniferous forest	1,619	1,366	738	699	437	(920)	(929)
Upland deciduous forest	1,092	805	349	1,233	1,000	141	195
Upland mixed coniferous/deciduous forest	21	18	2	51	0	30	(18)
Totals⁴	6,495	4,753	1,673	7,075	4,926	580	173

^{1,2,3} See Table 6.

⁴ Totals may differ from actual sums due to rounding.

Source: MDNR (2006).

Table 8
Wetland Types on Federal and Non-federal Lands

Wetland Types ¹	Federal Lands - Existing Conditions (acres)		Direct Project Impacts – Federal Lands (acres) ²	Non-federal Lands - Existing Conditions (acres)		Net Gain (Loss) to Forest Service after Land Exchange (acres)	
	Proposed Action	Alternative B		Proposed Action (All Lands)	Alternative B (Hay Lake Lands only)	Proposed Action ³	Alternative B ⁴
	Total Land Acres	6,495	4,753	1,673	7,075	4,926	580
Coniferous bog	1,961	1,677	505	0	0	(1,961)	(1,677)
Coniferous swamp	1,288	476	71	3,242	1,954	1,955	1,478
Hardwood swamp	21	14	13	58	8	37	(6)
Open bog	210	175	7	7	2	(202)	(173)
Deep marsh	0	0	0	0	0	0	0
Shallow marsh	97	81	23	117	84	20	3
Open water (includes shallow, open water, and lakes)	31	9	0	183	177	152	168
Shrub swamp (includes alder thicket and shrub-carr)	521	395	94	1,062	706	541	311
Sedge/wet meadow	36	35	35	0	0	(36)	(35)
Total Wetlands ⁵	4,164	2,861	747	4,670	2,931	505	70

¹ Wetland classification system based on Eggers and Reed (1997).

² Acres of direct impacts from the Project are the same for the Proposed Action and Alternative B. The area of direct impacts on the federal lands includes portions of the Mine Site and the Dunka Road and Utility Corridor.

³ The Proposed Action includes a land exchange of federal lands (6,495 acres) and non-federal lands (7,705 acres).

⁴ Alternative B includes a land exchange of federal lands (4,753 acres) and non-federal lands (Hay Lake Lands; 4,926 acres).

⁵ Totals may differ from actual sums due to rounding.

Sources: MDNR et al. (2013), PolyMet (2013, 2014).

Most upland habitat is associated with the central portion of the Mine Site. One Hundred Mile Swamp, which borders much of the Mine Site, is the dominant feature on the landscape. The Partridge River flows along and outside the northeastern and eastern boundary of the Mine Site (**Figure 3**).

Habitat observed on the Mine Site is typical of habitats associated with much of the Iron Range. Forest vegetation dominates the Mine Site (**Figures 9 and 12**). Most forest stands contain trees that are 12 inch diameter-at-breast-height (dbh) or less.

The site can be divided into three general areas. The northwestern area is dominated by lowland black spruce, with scattered stands of trembling aspen and balsam fir/trembling aspen; tamarack is also scattered throughout these stands (ENSR 2000, 2005). Most trees are estimated to be 60 years or older (USDA Forest Service 2000b). Interspersed within forest stands are brush/young tree stands in areas that were recently logged and that provide habitat for deer and moose. Several wetlands are found in the northwest area, with One Hundred Mile Swamp comprising most of the western and northern portions of this area, including the federal lands surrounding the Mine Site.

The northeastern area is dominated by nearly equal amounts of jack pine and black spruce, with scattered trembling aspen stands and speckled alder swamps (ENSR 2000, 2005). Although there are scattered black spruce stands containing trees greater than 60 years in age, most trees, especially jack pine, are 30 to 70 years in age (USDA Forest Service 2000b). There are a few recently logged areas within this area. Several large wetlands are found in this area. Most shrub/young tree habitat is associated with these wetlands and drainages.

The southern area contains a nearly equal mix of lowland and upland black spruce, jack pine, and trembling aspen, with some balsam fir and paper birch (ENSR 2000, 2005). Most tree stands are from 40 to 80+ years of age, although jack pine tree stands along Dunka Road are from 20 to 40 years of age.

Vegetation in the recently logged areas consists of grasses and ferns with trembling aspen saplings and speckled alder (ENSR 2000, 2005). The areas of more mature upland forests consist of jack pine, balsam fir, and trembling aspen, with lesser amounts of paper birch, red pine, and white pine. The mature lowland areas consist mainly of black spruce and tamarack growing on a bed of sphagnum moss and club moss with speckled alder, bog Labrador-tea, and leatherleaf. The open wetland areas consist of grasses, sedges, cattails, speckled alder, and pussywillow.

Approximately 1,719 acres of the Mine Site would be affected by the Project. **Table 9** shows the cover types that would be affected by the Project.

3.1.2 Federal Lands Surrounding the Mine Site

Federal lands surrounding the Mine Site encompass about 3,776 acres surrounding the Mine Site to the west, north, and east. This area has little topographic relief. The lands consist of a mosaic of slightly elevated upland areas surrounded by wetlands, and slope toward the east-northeast, in the direction of the Partridge River. Most (76%) of the area is wetland habitat, including a portion of One Hundred Mile Swamp, although upland habitat (24%) is an important component in the western portions of the area (**Figures 12 and 15, Table 6**). Yelp Creek flows from One Hundred Mile Swamp, joining the Partridge River, which flows around the northern, eastern, and southeastern edges of the federal lands, outside of the Mine Site (AECOM 2011a).

DESCRIPTION OF LANDS AFFECTED BY PROJECT

Forest vegetation dominates the federal lands. Most forest stands contain trees that are 12 inches dbh or less. The area can be divided into three general parts (AECOM 2011a). The eastern portion is dominated by the Partridge River. Large stands of lowland black spruce with scattered northern white cedar and tamarack are found in low areas associated with the river. Emergent and speckled alder wetland is adjacent to most of the river. Stands of immature (trees from 5 to 11 inches dbh, and from about 10 to 80 years of age) and mature (trees greater than 11 inches dbh and over 80 years of age) mixed coniferous/deciduous forest, coniferous forest dominated by jack pine, and smaller patches of immature deciduous forest, are found at higher elevations (USDA Forest Service 2000b).

The northern portion of the federal lands surrounding the Mine Site includes a portion of One Hundred Mile Swamp. The swamp is comprised of some young (trees less than 5 inches dbh and less than 10 years of age), but mostly immature and mature black spruce, northern white cedar, and tamarack forests (AECOM 2011a). Northern white cedar is prevalent in the northcentral portion of the northern area, while black spruce and tamarack are more common in the remaining areas. Scattered stands of speckled alder are associated with the swamp, as are bog and emergent wetlands, especially along the Partridge River. There are scattered “islands” of mature deciduous and mixed coniferous/deciduous forest. Most of the forest stands are 90 years or older, with many of the remaining stands 70 to 90 years of age (USDA Forest Service 2000b).

The western portion of the federal lands surrounding the Mine Site are dominated by lowland immature black spruce forest in its center, bordered by bog wetlands and wetlands dominated by speckled alder and red-osier dogwood (AECOM 2011a). A large area dominated by cattail is associated with the transmission line rights-of-way (ROW). Upland immature and mature deciduous and mixed coniferous/deciduous forest, with scattered stands of coniferous forest, surrounds the centrally located black spruce forest. Clearings comprised of grasses, forbs, and shrubs are associated with the transmission line ROW, while scattered low areas, dominated by emergent and shrub swamp wetland vegetation, are interspersed within upland forest habitats.

Table 9
GAP Cover Types Affected by the Project at the Mine Site

Cover Type	Affected Acres	Non-affected Acres	Total Cover Type Acres	Percent of Cover Type Affected
Upland coniferous forest	742	454	1,196	62
Lowland coniferous forest	437	344	781	56
Upland deciduous forest	355	293	648	55
Shrubland	133	109	242	55
Disturbed	44	84	128	34
Aquatic environments	6	7	12	50
Upland coniferous-deciduous forest	2	1	3	67
Cropland/grassland	<1	5	5	4
Lowland deciduous forest	0	<1	<1	0
Total	1,719	1,296	3,015	57

Source: MDNR et al. (2013).

3.2 Plant Site and Transportation and Utility Corridors

The Plant Site encompasses about 4,515 acres, which include the former LTVSMC processing plant, existing LTVSMC Tailings Basin, Area 1 Shop, Hydrometallurgical Residue Facility, and administration buildings. There is no federal land at the Plant Site.

The southwestern corner of the Plant Site, the former LTVSMC processing plant, has almost entirely been disturbed by past mining activities. No wetlands are present within this portion of the Plant Site, although there is a plant reservoir east of the concentrator that is not regulated as a wetland (PolyMet 2014a). The regulated wetlands within the Plant Site include a total of 52 wetlands covering approximately 245 acres. Using the MDNR GAP land cover types, approximately 61% (2,756 acres) of the Plant Site is disturbed and supports little vegetation. The remaining areas consist of trembling aspen and trembling aspen-paper birch forest (14%), aquatic habitat (14%), grass/brushland (7%), upland coniferous forest (2%), and lowland coniferous forest (1%; MDNR et al. 2013).

The Dunka Road and Utility Corridor is approximately 108 acres and the Railroad Connection Corridor is approximately 12 acres. There is no federal land in the Railroad Connection Corridor; however there is some federal land in the Dunka Road and Utility Corridor (**Figure 3**). Because of prior use during the former LTVSMC taconite mining operation, the Dunka Road and Utility Corridor is now defined as having a “disturbed” cover type. The remaining MDNR GAP land cover types that are not disturbed include cropland/grassland (8%), shrubland (6%), and smaller acreages of the remaining types. A total of 25 wetlands, encompassing approximately 7 acres, have been identified within the Dunka Road and Utility Corridor (MDNR et al. 2013).

3.3 Non-federal Lands

3.3.1 Hay Lake Lands

Hay Lake Lands are approximately 4,926 acres and have moderate topographic relief. The lands consist of a mosaic of slightly elevated upland areas surrounded by wetlands, and slope toward the east-northeast, in the direction of the Pike River (AECOM 2011b).

Most (59%) of Hay Lake Lands is wetland habitat, although upland habitat (41%) is an important component in the central and western portions of the lands (**Figure 16**). The Pike River, Hay Lake, and Little Rice Lake are dominant features of the landscape. The Pike River flows along the eastern boundary of the lands.

Forest vegetation dominates Hay Lake Lands. Nearly all forest stands contain trees that are 12 inches dbh or less, and most of the upland trees are 8 inches dbh or less. The lands can be divided into four general habitats. The eastern portion is dominated by the Pike River. Floodplain associated with river is dominated by emergent wetland with sedge and grass habitat, and shrub swamp wetland with speckled alder habitat. Wetland areas to the west of the river are dominated by lowland black spruce forest, with scattered northern white cedar and tamarack, and shrub swamp wetlands, especially in areas with evidence of past disturbance by logging activities.

Higher elevations in the northern, central, and western portions of the lands are dominated by upland deciduous and mixed coniferous/deciduous forest. Upland forest stands in the northern, central, and southwestern portions of the lands are immature to mature in size and age, while stands in the western portion of the lands are young to immature in size and age, having been harvested in recent years. Most trees are estimated to be 60 years or

younger. Two transmission line ROWs are found on the lands. Emergent wetland and upland grassland/shrubland vegetation dominates the ROWs. Abandoned logging roads are also found on the lands. Low areas along roads are dominated by emergent wetland vegetation consisting of sedges and grasses, while upland portions of roads are dominated by grasses and forbs.

3.3.2 Hunting Club Lands

Hunting Club Lands are approximately 160 acres, of which about 64 acres are wetland (**Figure 17, Table 5**). The lands drain to the north and then northeast via an unnamed creek. Several beaver dams are found along the creek. From this low area, the lands slope upward to the east and west. The lands consist primarily of shrub swamp wetland, with lesser amounts of emergent wetland, and upland immature and mature deciduous forests (AECOM 2011c).

Beaver ponds and dams are the dominant wetland features on the lands. Open water habitat is typical near the dams. Emergent vegetation, consisting of Canada bluejoint, narrow-leaved cattail, and sedges, is found in water from 12 to 24 inches deep, while shrub swamp is found near ponds at water depths from 6 to 18 inches. Speckled alder makes up to 80% of the cover in the shrub swamp wetlands. A large immature black spruce forest is found in the middle of Hunting Club Lands. The midstory consists of speckled alder, while leatherleaf, bog Labrador-tea, and sphagnum moss are found below the speckled alder. Immature black ash is found in a drainage leading to wetlands on the lands.

Habitat in the northwestern and northeastern portions and near the southern boundary of the lands is comprised of upland mature mixed coniferous/deciduous forest, dominated by eastern white pine to 24 inches dbh, and paper birch and trembling aspen to 12 inches dbh. The midstory consists primarily of balsam fir, while beaked hazel is found in the shrub layer.

The eastern and southern portions of the lands consist of patches of upland young and immature trembling aspen. The midstory consists of beaked hazel, with scattered black spruce and balsam fir. There is little ground cover. An “island” of trembling aspen-eastern white pine forest is found within the young and immature trembling aspen forest. It consists of young mature forest comprised of trembling aspen and eastern white pine to 16 inches dbh and black spruce to 12 inches dbh. There are many downed trees and much woody debris on the ground.

3.3.3 Lake County Lands

Lake County Lands consist of Lake County Lands North and Lake County Lands South.

3.3.3.1 Lake County Lands North

Lake County Lands North is approximately 265 acres, of which about 209 acres are wetland (**Figure 16, Table 5**). The lands have moderate topography, with the terrain generally sloping toward the southwest and Pine Lake. Lake County Lands North consists of two small areas to the north, and a single, small area to the south that is adjacent to Wolf Lands 1. The lands are comprised of mostly wetland habitat, except for areas of upland habitat on the northern portion of the northern area and on portions of the southern area. Portions of the lands have recently been logged. Wetland habitat consists mostly of immature coniferous forest, with lesser amounts of mature mixed coniferous/deciduous forest and shrubland. Upland habitat is dominated by mature deciduous and immature deciduous forests (AECOM 2011c).

Wetlands are comprised primarily of immature northern white cedar and black spruce with lesser amounts of tamarack, although several drainages also contain black ash. The midstory consists of balsam fir and black spruce, while speckled alder, leatherleaf, and bog Labrador-tea are found in the shrub layer. Club moss and sphagnum moss cover most of the ground.

Shrub swamp and emergent wetland habitats are also found on the lands. Shrub swamp habitat is associated with several drainages, a beaver pond, a bog area, and recently logged areas, while emergent wetland habitat was found near the beaver pond and on recently logged areas. Shrub swamp wetlands are dominated by speckled alder. Vegetation in the emergent wetlands consists of sedges and Canada bluejoint, with scattered black spruce, northern white cedar, tamarack, and speckled alder.

Upland habitats are comprised of immature and mature paper birch and black spruce, while recently logged areas supported young paper birch stands or shrub habitat. The midstory cover is comprised of balsam fir, black spruce, and beaked hazel. Young paper birch with scattered young trembling aspen and scattered immature paper birch are in areas that had been recently logged.

Older forests contain large amounts of downed woody material; this material is mostly absent in logged areas. Tree wind-throw is common in forest stands adjacent to the clearcuts, and walking in these forests is difficult due to downed trees and woody debris, and the dense stand of balsam fir, black spruce, and northern white cedar in the midstory.

3.3.3.2 Lake County Lands South

Lake County Lands South is approximately 117 acres, of which about 74 acres are wetland (**Figure 16, Table 5**). The lands are relatively flat in the northwest, rise in elevation to the northeast, and fall in elevation to the southeast. Water flows from west to east. A series of beaver dams and ponds dominate the landscape. Several areas have been recently logged and the dominant upland habitat is shrubland (AECOM 2011c).

Forested wetlands dominate the western and southeastern portions of the lands and are comprised of immature and mature black spruce and northern white cedar, although immature tamarack is found in some forest stands and immature black ash is an important component of several drainages. The midstory consists of balsam fir and black spruce. Speckled alder, leatherleaf, bog Labrador-tea, and red-osier dogwood are common shrubs, while sphagnum moss covered most of the ground. Forests in the northwestern portion contain a dense mix of northern white cedar and black spruce with scattered black ash in the drainages. The northwestern area of the northwestern portion is dominated by immature and mature northern white cedar.

Five beaver ponds were found on the lands. These ponds are comprised of open water with scattered dead spruce surrounded by emergent wetland dominated by sedges, narrow-leaved cattail, woolgrass, and Canada bluejoint, or by dense stands of speckled alder in shallow-water areas. Shallower-water drainages, especially in areas that have been logged, are covered by speckled alder, sedges, and narrow-leaved cattail.

Most upland areas have been recently clear-cut, with the exception of the southwestern section of the lands. This area has been partially thinned, leaving areas where mature paper birch, black spruce, jack pine, eastern white pine, and northern white cedar trees remain, ranging from 12 to 24 inches dbh. Balsam fir and beaked hazel are found in the midstory, while forbs and grasses cover the ground layer. Because of recent logging activity, woody debris and large downed trees are abundant.

3.3.4 McFarland Lake Lands

McFarland Lake Lands are about 31 acres on a hillslope that rises from 1,483 feet above mean sea level at McFarland Lake to 1,778 feet above mean sea level on the western boundary of the lands. Rocky cliffs, about 150 feet in height, are found at the top of the hillslope and large boulders are found on the hillslope (AECOM 2011c).

McFarland Lake Lands are dominated by deciduous and mixed coniferous/deciduous forest habitats (**Figure 17, Table 5**). Tree sizes and ages range from immature to mature. Some logging has occurred at the top of the hillslope along the western boundary of the lands.

3.3.5 Wolf Lands

Wolf Lands total 1,576 acres and consist of four parcels, Wolf Lands 1, 2, 3, and 4.

3.3.5.1 Wolf Lands 1

Wolf Lands 1 is approximately 126 acres, of which about 90 acres are wetland (**Figure 16, Table 5**). Most upland habitat consists of mature coniferous and deciduous forest, while most wetland habitat consists of immature coniferous forest. The lands are relatively flat but slope gently downward toward the southwest. The lands are adjacent to Lake County Lands North (AECOM 2011c).

Wetland communities are comprised primarily of young and immature forests in nearly equal amounts. Young forests are comprised of black spruce, with scattered northern white cedar and tamarack. Young forests have characteristics of more open bogs, as tree cover is sparse, trees are short, and most of the ground is covered by bog Labrador-tea and leatherleaf, and sphagnum moss. In immature forests, the canopy is dominated by 6 to 10 inches dbh black spruce, with tamarack and northern white cedar also present. The midstory consists of balsam fir and black spruce, while speckled alder, leatherleaf, bog Labrador-tea, and red-osier dogwood dominate the shrub layer. Club moss and sphagnum moss cover most of the ground (AECOM 2011c).

Upland mixed coniferous/deciduous immature and mature forest is found in the southwestern portion of the lands. Paper birch and trembling aspen cover about half of the area, and the midstory consists of mostly balsam fir; beaked hazel, and red-osier dogwood.

3.3.5.2 Wolf Lands 2

Wolf Lands 2 is approximately 769 acres, of which about 706 acres are wetland (**Figure 16, Table 5**). The lands consist of gently undulating terrain and slope toward the southwest. Water generally flows to the southwest and to Mary Ann Creek, Wenhoo Creek, and Greenwood Lake. The lands consist primarily of wetlands comprised of immature black spruce and northern white cedar forest, while shrub swamp comprised of speckled alder also is common. Black spruce is the dominant tree in wetlands in the northern and eastern portions of the lands, while northern white cedar is more prevalent in other portions of the lands (AECOM 2011c). Several drainages are dominated by speckled alder or have a black ash component, while emergent wetland habitat is associated with beaver ponds. Most upland habitat consists of immature mixed coniferous/deciduous forest.

Wetland immature forests are of three types: black spruce dominant, a mix of black spruce and northern white cedar, or northern white cedar dominant. Canopy trees range from 4 to 8 inches dbh. The midstory consists of

young black spruce, northern white cedar, and balsam fir. Bog Labrador-tea comprises 10 to 30% of the low shrub cover, while sphagnum moss often covers more than 80% of the ground.

Several drainages are dominated by shrub swamp vegetation. These drainages generally have a sparse overstory of black spruce, northern white cedar, and tamarack. Speckled alder and young trees are in the midstory while low shrub cover consists of bog Labrador-tea.

Beaver dams and ponds are found in the southeastern portion of the lands. Typically, open water is adjacent to the dams, with emergent wetland surrounding the open water and shrub swamp wetland upstream of the dams.

Upland habitat in the northern portion of the lands consists of an overstory of young and immature mixed coniferous/deciduous forest over a shrub layer of beaked hazel. Some of the upland area on the northern portion of the lands has been logged. Upland habitat is also found in the southern portion of the lands and is comprised of paper birch, trembling aspen, and black spruce, over a midstory of balsam fir and shrub layer of beaked hazel.

3.3.5.3 Wolf Lands 3

Wolf Lands 3 is approximately 277 acres, of which about 233 acres are wetland (**Figure 17, Table 5**). The lands are relatively flat and Coyote Creek begins its northward flow within the lands. Wetlands are dominated by shrub swamp and immature coniferous forest habitat, while uplands consist of mostly shrubland and immature deciduous forest (AECOM 2011c).

About half of the lands have been recently logged. Logged wetlands are dominated by grasses, forbs, and low growing shrubs, including red-osier dogwood and speckled alder. In shrub swamp wetlands, speckled alder dominates. Bog Labrador-tea is often thick in areas where there is a dense cover of speckled alder. Vegetation on logged uplands includes grasses, forbs, and beaked hazel.

In the unlogged areas, wetland forests are comprised of immature black spruce. In the northern portion of the lands, black spruce is co-dominant with tamarack; in the rest of the lands, tamarack is present in the canopy but in much lower amounts. The midstory consists of balsam fir and black spruce, while the shrub layer is dominated by bog Labrador-tea, over a ground layer of nearly continuous sphagnum moss with scattered grasses and forbs. There are numerous downed trees and much woody debris associated with tree wind-throw in areas adjacent to the clearings.

Coyote Creek is bordered by emergent sedge meadow wetland comprised of sedges, narrow-leaved cattail, and Canada bluejoint. There are also scattered young tamarack and northern white cedar, as well as scattered patches of speckled alder and bog Labrador-tea. The emergent wetland is bordered by dense speckled alder. Water depth in the emergent and shrub swamp wetlands is about 18 to 24 inches.

Upland areas within the lands have been logged recently. Most of these areas have few trees remaining, though some areas still support paper birch up to 16 inches dbh and scattered balsam fir. The upland habitat along the boundary of the lands consists of both young and mature paper birch with scattered black spruce and northern white cedar, over an understory comprised of balsam fir.

3.3.5.4 Wolf Lands 4

Wolf Lands 4 is approximately 405 acres, of which about 363 acres are wetland (**Figure 17, Table 5**). Coyote Creek bisects the lands, while the Stony River is found about 2,000 feet northwest of the lands. Timber harvests have recently occurred along the western border of the lands. Wetland habitats are dominated by immature coniferous forest and shrub swamp, while upland habitat consists primarily of mature deciduous forest (AECOM 2011c).

Coniferous forest dominates the wetland habitat. Black spruce forest dominates in the northern half of the lands, while northern white cedar is more prevalent in the southern half of the lands. Immature-size trees prevail over most of the lands, but patches of young black spruce are more common in the northeastern portion of the lands, and young northern white cedar and black spruce are more common in the southwestern portion of the lands. Emergent communities comprised of sedges and Canada bluejoint, and shrub swamp communities comprised primarily of speckled alder, are found in floodplains that border Coyote Creek.

Immature black spruce and black spruce/northern white cedar wetlands are dominated by trees ranging from 4 to 8 inches dbh. Scattered young and immature tamarack is also found in these wetlands. The low shrub layer is nearly continuous, and is comprised of leatherleaf, bog Labrador-tea, and other vegetation. Sphagnum and club mosses cover most of the ground.

Shrub swamp is dominated by speckled alder, with scattered black spruce, tamarack, and northern white cedar in the overstory. Leatherleaf and bog Labrador-tea cover comprise about 40 to 50% of the shrub layer.

Upland habitat consists of immature and mature paper birch and some black spruce. Trees are up to 18 inches dbh, although a 30 inches dbh jack pine and several large red pines to 24 inches dbh are found on the lands. Balsam fir is common in the midstory, while beaked hazel and raspberry are dominant in the shrub layer. In areas that have been logged recently, young paper birch is common over a shrub layer of beaked hazel, raspberry, and bog Labrador-tea.

4.0 Biological Evaluation Methodology

This section discusses the methods and references used for the literature review, database inquiries, consultations, field studies, and effects determination for the BE. This information is used in Section 5.0 for the analysis and determination of effects for all RFSS plants and animals.

4.1 Literature Review

4.1.1 Biological Evaluations

Several recent BEs have been prepared for proposed actions on or near the federal and non-federal lands and provided information that is used in this BE and include:

- *Forest Plan Revision Chippewa and Superior National Forests Regional Forester Sensitive Plants Biological Evaluation* (USDA Forest Service 2004c) and *Forest Plan Revision Chippewa and Superior National Forests Regional Forester Sensitive Animals Biological Evaluation* (USDA Forest Service 2004d; collectively 2004 Forest Service BEs) – evaluated potential effects to RFSS plants and animals from proposed vegetation management activities in the Chippewa and Superior National Forests, including federal lands.
- *Whyte Forest Management Project Laurentian Ranger District, Superior National Forest Biological Evaluation Region 9 Regional Forester Sensitive Species* (USDA Forest Service 2006) – evaluated potential effects to RFSS plants and animals from proposed forest management activities in Lake County.
- *Tracks Forest Management Project Laurentian Ranger District, Superior National Forest Biological Evaluation Region 9 Regional Forester Sensitive Species* (Tracks Project BE; USDA Forest Service 2010b) – evaluated potential effects to RFSS plants and animals from proposed forest management activities on the Tracks Forest Management Project (Tracks Project) area east of Hoyt Lakes and north of Brimson, Minnesota, in Lake and St. Louis Counties, and near the Project area. The Track Project area encompasses about 152,000 acres of land of which approximately 78,000 acres are in the Superior National Forest.
- *Regional Forester Sensitive Species Biological Evaluation for the Federal Hardrock Mineral Prospecting Permits Final EIS Appendix I Superior National Forest* (USDA Forest Service 2012) – evaluated potential effects to RFSS plants and animals from proposed hardrock mineral prospecting activities in the Superior National Forest, including the federal lands.

4.1.2 Other Sources of Information

- *Winter 2000 Wildlife Survey for the Proposed NorthMet Mine Site, St. Louis County, Minnesota* (ENSR 2000).
- *Land and Resource Management Plan for the Superior National Forest* (USDA Forest Service 2004a).
- *NorthMet Mine Summer Fish and Wildlife Study* (ENSR 2005).
- *2009 NorthMet Mine/Forest Additional Parcel Northern Goshawk and Owl Survey – Final Report* (AECOM 2009).

- *2008 NorthMet Mine/Forest Service Additional Parcel Summer Wildlife and Wetland Assessment – Final Report* (AECOM 2011a).
- *2009 Hay Lakes Parcel and McFarland Lake Parcel Summer Wildlife and Wetland Assessment Final Report* (AECOM 2011b).
- *Hunting Club, Lake County, and Wolf Land Parcels Fall 2010 Wildlife and Wetland Assessment Final Report* (AECOM 2011c).
- *NorthMet Mining Project and Land Exchange Draft Supplemental EIS* (MDNR et al. 2013).
- *Superior National Forest Bat Monitoring: Summary of 2013 Survey Effort* (Grandmaison et al. 2013).
- *Summary of Acoustic and Emergence Surveys for Bats in the NorthMet Project Area* (USDA Forest Service 2014a).
- *Summary of the 2014 Minnesota Northern Long-eared Bat Summer Habitat Use in Minnesota Project (Preliminary Report)* (USDA Forest Service 2014b).

4.2 Database Inquiries

The MDNR Natural Heritage Information System (NHIS) Rare Features database was queried for sightings of RFSS within the federal and non-federal lands (MDNR 2014a).

4.3 Consultation with Biologists with Local Knowledge of the Species

Telephone and in-person interviews were conducted with agency and other personnel with knowledge of RFSS in the region, including staff with the MDNR, Forest Service, and University of Minnesota.

4.4 Field Studies

4.4.1 Federal Lands

Several studies have been conducted for RFSS plants and animals on the federal lands. Three rare plant surveys were conducted on the proposed Mine Site during July 2004 (Johnson-Groh 2004, Pomroy and Barnes 2004, Walton 2004). A variety of habitats were surveyed and Global Positioning System (GPS) was used to record the locations of rare plant occurrences. Photographs were taken of specimens in their habitats, and representative specimens were collected, pressed, dried, and analyzed in the laboratory. Characteristics of the habitat were recorded at each location where RFSS plants were observed.

Surveys for moonworts, which are rare ferns, were conducted in July 2004 on the Mine Site using protocol developed by Johnson-Groh (2004) for the Forest Service. Areas with high potential for having moonworts were searched on hands and knees using the timed meander search approach.

Barr Engineering Company (Barr; 2007a) conducted surveys for ternate grapefern in late August and early September 2007. Surveys were conducted along the Dunka Road and other roads for the Project. The majority

of vegetation cover types on the Project area do not provide suitable habitat for St. Lawrence grapefern. Characteristics of the habitat were recorded at each location where RFSS plants were observed.

ENSR conducted studies of wildlife use of the proposed Mine Site in 2000 (winter study) and 2004 (summer study; ENSR 2000, 2005). In addition to determining general wildlife use of the area during January and March 2000 and June 2004, the study also determined the presence of RFSS wildlife species and important habitats used by RFSS and other wildlife species. These studies involved: 1) reviewing federal and state agency and conservation group databases for known and historic occurrences of RFSS species in the proposed Mine Site area; 2) reviewing previous plant and animal surveys conducted on or near the proposed Mine Site; 3) consultation with agency and conservation group biologists; 4) field surveys to record wildlife and their habitats on the site; and 5) calling surveys for wolf, raptors, and several species of woodpeckers, including RFSS species. In addition, a vegetation cover type map was prepared showing the habitat types on the site, including disturbed, wetland, and upland habitats. Within the wetland and upland habitat types, open water, emergent and bog wetland, grassland, shrubland, and deciduous, mixed deciduous/coniferous, and coniferous forest habitat types were recorded.

In October 2004, David Heath conducted studies of the freshwater mussel fauna in two reaches of the Partridge River, one reach of the Embarrass River, and one reach of Trimble Creek (Heath 2004). Mussels were collected by hand using Self-contained Underwater Breathing Apparatus (SCUBA) and snorkeling equipment.

In February 2005, Dan Breneman conducted a stream and wetland biological survey in the Project area (Breneman 2005). The survey was conducted on four stream sites and two wetland sites. Fish and macroinvertebrate community composition, habitat characteristics, and water chemistry parameters were examined to establish biological condition at these sites. Fish were sampled by electrofishing in streams, and with 24-hour trap net sets in wetlands. Macroinvertebrates were collected with D-frame kick nets and Hess, Ekman, or Petite Ponar dredge sampling gear. Total number of fish and total length per species were determined within each stream reach to estimate catch-per-unit effort. Macroinvertebrates were identified and enumerated, and the relative abundance and taxa richness per site were determined. Stream habitat characteristics and water quality parameters at each site were summarized by point estimates along randomly spaced transects.

Wetlands on the Mine Site were initially mapped in June 2004 by ENSR based on a general field survey of the area for wetland and upland habitats (ENSR 2005). The location and boundaries of wetlands were determined based primarily on vegetative and hydrologic characteristics of the sites (wetland boundaries were not mapped using GPS).

Between 2004 and 2012, Barr evaluated wetlands across the federal lands, including the Mine Site. Barr conducted wetland delineations across several Project areas between 2004 and 2006 (PolyMet 2013, 2014). In 2007, Barr evaluated wetlands on approximately 2,420 acres of the federal lands surrounding the Mine Site that were not evaluated as part of the 2004 to 2006 studies (Barr 2007b). Wetlands in this area were identified from field studies and aerial interpretation. Along the Dunka Road and other possible transportation routes, Barr conducted field studies to determine wetland boundaries, vegetation cover types, and plant species composition of wetlands identified in this area. For areas outside of the Dunka Road and possible transportation routes, wetlands were mapped primarily based on the presence of photographic signatures with limited field-truthing and GPS-locating. Barr also assessed wetland functions and values for these wetlands.

In September 2007 and August 2008, Barr assessed plant species of concern on portions of the federal lands surrounding the Mine Site (Barr 2007a, 2009a, 2011).

In August 2008, AECOM conducted studies of wildlife use of lands surrounding the Mine Site (AECOM 2011a). The study also determined the presence of RFSS wildlife species and important habitats used by RFSS and other wildlife species, and followed protocols used during 2000 and 2004 surveys of the Mine Site. In April 2009, AECOM conducted calling surveys for northern goshawk and owls, and made observations of other wildlife, on the federal lands surrounding the Mine Site (AECOM 2009).

The USFS Superior National Forest staff conducted surveys for the northern long-eared bat and little brown bat at three general locations in the Project area in July and August 2014 (Smith et al. 2014). The three Project locations included the Mine Site, the Plant Site, and the Dunka Road and Utility Corridor. Survey methods utilized passive sonic (Anabat) detectors on the Mine Site and Dunka Road and Utility Corridor. At the Plant Site, the methods were primarily direct observation of bat species, supplemented by passive sonic detectors when feasible.

4.4.2 Non-federal Lands

In June 2009, AECOM evaluated wildlife and their habitats and conducted northern goshawk, owl, bat, and gray wolf surveys on about 4,760 acres of non-federal lands on Hay Lake Lands and McFarland Lake Lands (AECOM 2011b). In November 2010, wildlife and their habitats, and wetland functions and values, were evaluated on the Lake County Lands, Hunting Club Lands, and Wolf Lands (AECOM 2011c). During both wildlife surveys, AECOM also mapped upland and wetland habitats on the lands and evaluated wetlands for their functions and values. Survey protocols were similar to those used by ENSR and AECOM for the federal lands.

An assessment of RFSS plant species was not conducted for the non-federal lands as these lands would not be disturbed by the Project. Information on RFSS occurrence on or near the lands was obtained from the MDNR (2014) NHIS database and from Forest Service observations on and near the lands. However, these sources do not provide the same level of detail as the plant surveys conducted on the federal lands, so lack of occurrence data does not conclusively indicate that an RFSS plant species is not present on the non-federal lands. Should these lands be acquired by the Forest Service under the land exchange, the Forest Service would conduct RFSS surveys prior to conducting ground-disturbing activities, such as road building and timber harvesting.

4.5 Determination of Effects

4.5.1 Types of Effects and Assessment Factors

Section 5.0 includes background information and an analysis of the effects of the Project on the RFSS listed in **Table 1**, which are species that have occurred or are likely to occur, and/or have habitat or are likely to have potential habitat, on the federal and/or non-federal lands. For each RFSS, background information on species abundance and distribution and habitat requirements is presented. Potential beneficial and adverse direct and indirect effects to the species that are related to the proposed action and alternatives, and that may result from the Proposed Action or alternatives, are presented. Effects of future actions on RFSS, and that are reasonably likely to occur in the areas considered in this BE, or cumulative effects, are also discussed. These effects are defined as follows:

- Beneficial – Effects of an action that are wholly positive, without any adverse effects, on a RFSS or designated habitat. Determination that an action will have beneficial effects is a “may impact” situation.
- Direct – The direct or immediate effects of the Project on a RFSS or its habitat. Direct effects result from the proposed action including the effects of interrelated actions and interdependent actions.
- Indirect – Effects caused by or resulting from the proposed action, which are later in time, and are reasonably certain to occur. Indirect effects may occur outside of the area directly affected by the action.
- Cumulative – Include the effects of future state, tribal, local, or private actions that are reasonably certain to occur in the cumulative effects study area (CESA) and are considered in this BE.

The effects assessment is based on the following factors:

- the dependency of the species on specific habitat components,
- habitat abundance,
- population levels of the species,
- the degree of habitat impact, and
- the potential to mitigate for an adverse effect.

4.5.2 Cumulative Effects

Cumulative effects include the effects of future state, tribal, local, or private actions that are reasonably certain to occur in the CESA considered in this BE.

The CESA includes the Nashwauk and Laurentian Uplands ecological subregions within the Arrowhead Region of Minnesota. This area totals approximately 1.38 million acres in the northeast corner of Minnesota (**Figure 18**; Emmons and Olivier Resources, Inc. 2006). The period for analysis of cumulative effects in this BE was from pre-settlement (approximately 1890) through closure and reclamation of Project facilities (approximately 40 years).

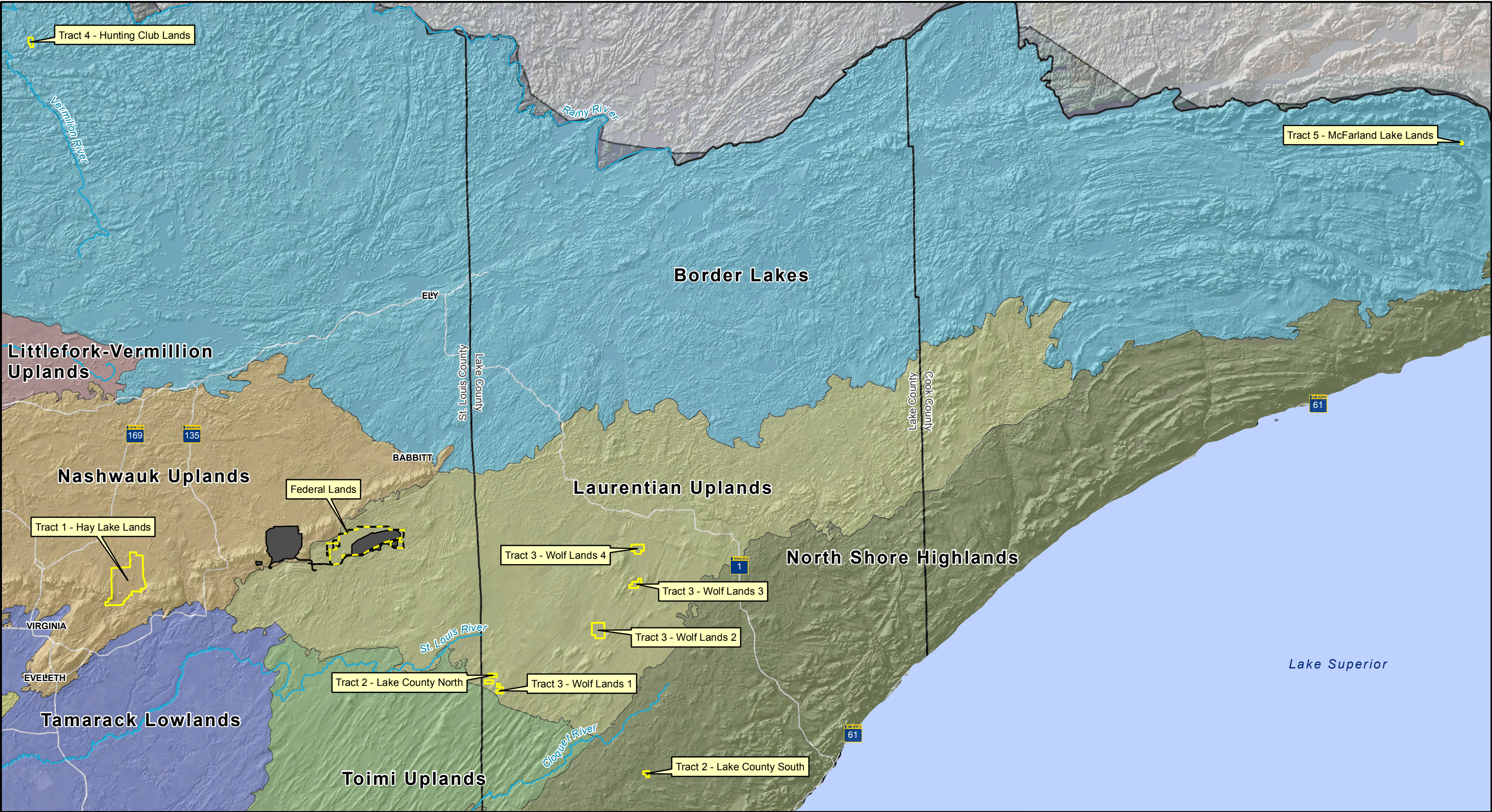
Cumulative effects to plants and animals are discussed in Chapter 6 of the FEIS (MDNR et al. 2015). The effects discussed in that section were based on an analysis conducted for a 2006 MDNR report titled *Cumulative Effects Analysis on Wildlife Habitat and Travel Corridors in the Mesabi Iron Range and Arrowhead Regions of Minnesota* (Emmons and Olivier Resources, Inc. 2006), and a report titled *Cumulative Effects Analysis of Wildlife Habitat and Threatened and Endangered Wildlife Species* (Barr 2009b).

In accordance with Council on Environmental Quality guidance on June 24, 2005 (Council on Environmental Quality 2005), past actions associated with the Project are addressed through their current aggregate effects and have not been provided as a list of individual projects in this BE. The FEIS identifies a number of proposed projects that should be considered reasonably foreseeable future actions and that may contribute to cumulative effects to plants and animals. These include mining and other land development activities, and land management activities such as timber harvest, prescribed fire, and road construction that may be authorized or carried out on nearby federal, state, and private lands and that are likely to have both positive and negative effects to RFSS.

Based on analysis conducted by Emmons and Olivier Resources, Inc. (2006:30, 38), approximately 1,700 acres of wildlife habitat were lost from the Nashwauk and Laurentian Uplands ecological subregions between 1890 and the 1990s, with loss due to forestry and mining accounting for 89% of the loss. In most of the region, forest communities have transitioned from predominately pine- and tamarack-dominated forests to trembling aspen and other non-pine community-dominated forest species. Forest composition has changed, and the Minnesota Forest Resource Council (2003) concluded that forest fragmentation has increased, with decreased forest stand sizes and more miles of forest edge.

Barr (2009b) estimated habitat loss due to mining at about 17,000 acres over the next 25 to 30 years. In the future, the rate of habitat loss due to mining would decrease as vegetation establishes on disturbed lands. Potential disturbances to habitat within the Laurentian Uplands ecological subsection would be primarily due to timber harvest and mining, and habitat types most likely to be affected include upland and lowland coniferous forest, upland deciduous forest, and upland shrub/woodland. Within the Nashwauk Uplands ecological subsection, mining activities and urban development would be more likely to affect habitat, with upland deciduous forests and upland shrub/woodland habitats most affected (Emmons and Olivier, Inc. 2006).

Although more land would be impacted by timber management than mining in the future, forestry management offers a greater range of options for RFSS to co-exist with the practice, as it can mimic natural disturbances, whereas mining represents a complete land conversion that could affect long-term RFSS habitat availability. Between 2005 and 2014, within the Laurentian Uplands ecological subregion, an average of approximately 1,034 forest acres were (or would be) harvested annually on state lands (0.2% of the subregion). Between 2010 and 2019 within the Nashwauk Uplands ecological subregion, an average of approximately 1,189 forest acres were (or would be) harvested annually on state lands (0.1% of the subregion). On average, 1% of timber land in the Superior National Forest is harvested annually (MDNR et al. 2013). Private timber harvest data are generally not available.



- | | | |
|-------------------|-------------------------------|-----------------------|
| Federal Lands | Ecological Subsections | North Shore Highlands |
| Non-federal Lands | Border Lakes | St. Louis Moraines |
| Project Areas | Laurentian Uplands | Tamarack Lowlands |
| Major River | Littlefork-Vermillion Uplands | Toimi Uplands |
| | Nashwauk Uplands | |

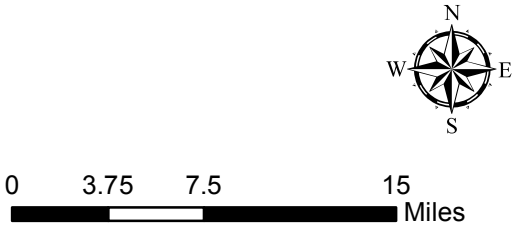


Figure 18
Arrowhead Region of Minnesota and
Ecological Subsections
Biological Evaluation for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

5.0 Analysis and Determination of Effects

This section discusses all RFSS plants and animals that are known or suspected to occur on the federal and/or non-federal lands, or that may have habitat on the lands, as identified in **Table 1**. Primary sources of information used to describe the environmental baseline condition are the *NorthMet Mining Project and Land Exchange Draft SEIS* (MDNR et al. 2013 and references cited therein), *Tracks Project BE* (USDA Forest Service 2010b and references cited therein), MDNR Rare Species Guide (MDNR 2008 and references cited therein), MDNR NHIS Rare Features Database (MDNR 2014a), and Bell Museum of Natural History (2013) Scientific Collections database.

Plant habitat cover types and acreages used in the description of habitat conditions and for Project effects analysis are based on MDNR (2006) for GAP cover types, USDA Forest Service (2010a) for MIH cover types, and MDNR et al. (2013) and PolyMet (2013,2014) for wetland habitat cover types.

Plant population numbers correspond to the MDNR Element Occurrence within the NHIS database (MDNR 2014a). According to the 2014 MDNR NHIS training notes, Element Occurrences may have multiple observations in a given area, but are considered one population if they are “within close enough proximity to one another to allow for gene flow and there are no known barriers to movement.” These clusters of observations are described here as colonies for given populations. An individual is defined as a single plant of a species. A colony is a group of individual plants of one species in a distinct geographic location. A population is a group of individuals or colonies of one species that may be separated geographically, but are close enough to interbreed and persist over time.

Other sources of information for the BE are provided in Section 4.0. Information in Section 5.0 may be assumed to be from one of these sources. Any additional information that is not from one of these sources is cited in the text.

5.1 Vascular and Non-vascular Plants

5.1.1 Plants Not Evaluated in the Biological Evaluation

As shown in **Table 1**, there is no suitable habitat on the federal or non-federal lands for alpine milkvetch, *Arctoparmelia centrifuga*, *Arctoparmelia subcentrifuga*, creeping rush, Chilean sweet-cicely, Douglas’ hawthorn, little goblin moonwort, long-leaved arnica, nodding saxifrage, Oakes’ pondweed, Scotch false asphodel, short sedge, smooth woodsia, and Wain’s cup lichen. The Proposed Action, Alternative B, and No Action Alternative would have **no impact** to individuals of these species, and they will not be addressed further in this BE.

5.1.2 Plants of Non-forested Wetlands, Shallow Water, and Riparian Areas (Habitat Group 1)

5.1.2.1 Environmental Baseline

Habitat Group 1 RFSS favor non-forested wetland habitat, shallow water, and riparian areas. The following Habitat Group 1 RFSS either occur on, and/or have suitable habitat on, the federal and/or non-federal lands—small beggarticks, floating marsh marigold, linear-leaved sundew, quill spikerush, moor rush, auricled twayblade, American shoreweed, bog muhly, Leiberg’s waterlily, American waterawlwort, and bog white violet.

ANALYSIS AND DETERMINATION OF EFFECTS

Of these species, floating marsh marigold, quill spikerush, and moor rush are found on the federal lands. No Habitat Group 1 RFSS have been reported on the non-federal lands.

Species Conditions

Small Beggarticks (*Bidens discoidea*)

In Minnesota, small beggarticks is restricted to a relatively few lakes in the northeast counties, including St. Louis and Cook Counties, where it is found along boggy shorelines and floating mats in partial to full sunlight (Minnesota Wildflowers 2013).

Small beggarticks has not been reported on the federal or non-federal lands, or on the Tracks Project area. As discussed in Section 4.1.1, the Tracks Project area is east of Hoyt Lakes and north of Brimson, Minnesota, in Lake and St. Louis Counties, and near the Project area. The Tracks Project area encompasses about 152,000 acres of land of which approximately 78,000 acres are administered by the Forest Service.

Floating Marsh Marigold (*Caltha natans*)

Floating marsh marigold was first collected in Minnesota in 1889 from Vermilion Lake in St. Louis County. All subsequent collections have been from St. Louis County, including the federal lands and Tracks Project area. Very few populations are known in Minnesota. Habitat loss is the primary reason behind recent local extirpations of this species in Minnesota.

Floating marsh marigold is a perennial aquatic forb and occurs within shallow open water or on moist mud within northern ponds, lakes, slow-moving rivers, streams, ditches, and wet meadows. Floating marsh marigold is found in relatively stable aquatic systems and may be sensitive to disturbances, including alteration of hydrology or hydro-period, water quality, water chemistry, and non-native species invasion, although a few populations are found on disturbed habitats.

Of the 12 known populations statewide, 3 populations, totaling 22 individuals, occur on the federal lands north of the Mine Site along the Partridge River. The populations would not be disturbed by mining. Nine additional populations of floating marsh marigold occur on privately owned lands south of the Mine Site, and along Dunka Road. One of these populations would be directly affected by a Waste Rock Stockpile.

Floating marsh marigold has not been reported on the non-federal lands.

Linear-leaved Sundew (*Drosera linearis*)

In Minnesota, linear-leaved sundew has been found in Lake County, but not in St. Louis or Cook Counties. It is one of a small group of rare plant species that are restricted to a high-quality, undisturbed, type of peatland called patterned fens. These fens tend to develop at the core of large peatland complexes in northern Minnesota. Like all sundews, linear-leaved sundew is a small, inconspicuous plant with one outstanding feature; the leaves are covered with mucilage-tipped tentacle-hairs that are adapted to trap insects. Protection of fen habitat is essential to the survival of this species.

Linear-leaved sundew has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Quill Spikerush (*Eleocharis nitida*)

Quill spikerush distribution in Minnesota is limited to the northeastern counties of the Arrowhead region and west to Itasca County. Quill spikerush was first collected in Minnesota in 1946 from various wetland habitats in Cook and St. Louis Counties. Despite the long collection record for this species in Minnesota, relatively few populations have been documented and little is known about the overall distribution of the species throughout the state.

Quill spikerush occurs within various wetland habitats of northern Minnesota, including acid bog pools, small streams, areas of seasonal water drawdown (mucky/peaty flats), disturbed wetland edges, and along roads and trails. This rooted perennial species may be intolerant of hydrologic fluctuations and alterations to water quality and chemistry associated with landscape and wetland alteration and development. However, roadside distributions suggest the species may be semi-tolerant to disturbance and at least mild alterations in water quality in the short term.

Of the 49 known populations in the state, 1 population occurs within the federal lands, on the Mine Site, and would be affected by the Project. There are an additional 13 locations of this species on private lands located along Dunka Road and the railroad tracks south of the Mine Site. Project activities would directly affect four of these populations.

Quill spikerush has not been reported on the non-federal lands. It has been reported on the Tracks Project area.

Moor Rush (*Juncus stygius* var. *americanus*)

Moor rush is distributed across the northern and northeastern Arrowhead counties in large patterned peatlands and calcareous fens. It was first documented in St. Louis County in 1886. In 2003, it was reported in Carlton County (one occurrence), Koochiching County (five occurrences), and Lake County (four occurrences; USDA Forest Service 2004e). It is generally not a dominant species. Even in ideal, large-patterned peatland settings, it occurs in isolated colonies with scattered individuals.

Moor rush is a perennial graminoid species that occurs in full sun, and generally, it is restricted to narrow wet zones of the margin of a bog pond. Moor rush has very specific hydrology requirements and the principal threats are large-scale disturbances to its peatland habitat and surrounding watersheds. These threats include mineral exploration, peat mining, pollution of watershed waters, alterations of hydrologic regime, and acid rain (USDA Forest Service 2004e and references cited therein).

Of the 30 known populations in Minnesota, 1 population consisting of 67 individuals scattered within a 450-foot radius was found on the federal lands within One Hundred Mile Swamp in bog habitat with scattered black spruce (PolyMet 2013).

Moor rush has not been reported on the non-federal lands. It has been reported on the Tracks Project area.

Auricled Twayblade (*Listera auriculata*)

Auricled twayblade ecology is poorly understood and the species has a very limited distribution. It is found in St. Louis, Lake, and Cook Counties, including along the North Shore of Lake Superior, and at Isle Royale National Park. It is rarely encountered and, until recently, little was known about its distribution and habitat

ANALYSIS AND DETERMINATION OF EFFECTS

requirements. The species is very rare in Minnesota, prompting its listing as a state endangered species in 1996. Its persistence is precarious because there are so few populations and most populations have few individuals.

In Minnesota, it is characteristically found along streams or pond margins in low, moist hardwood forests, mixed coniferous/deciduous forest, and shrub swamps (Hoy 2001). Habitat destruction related to high water levels and vegetation succession, either by human alteration or by natural processes is a potential threat.

Auricled twayblade has not been reported on the federal or non-federal lands, or on the Tracks Project area.

American Shoreweed (*Littorella americana*)

American shoreweed occurs in the northeastern U.S. and adjacent Canada, and is considered vulnerable or imperiled across much of its range due to its rarity and threats to its habitat. It currently reaches the westernmost extent of its distribution in the Laurentian Uplands ecological subregion of northeastern Minnesota. The species was first collected in 1886 from Basswood Lake in Lake County. Since that time, 60 additional occurrences have been documented in the state, including in St. Louis, Lake, and Cook Counties, primarily in the BWCAW.

American shoreweed is an aquatic plant primarily occurring in lakes having a sandy, gravel/cobble substrate. In some lakes, plants may become partially or wholly buried in fine organics or silts. Plants are most often observed when they become stranded along the lakeshore.

American shoreweed has not been reported on the federal or non-federal lands. It has been reported on the Tracks Project area.

Bog Muhly (*Muhlenbergia uniflora*)

Bog muhly is a small, fine grass primarily distributed in northeastern North America and ranging as far west as Minnesota. It is found in Lake and Cook Counties, primarily in the BWCAW. The species was first reported in Minnesota from St. Louis County in 1956 and from Lake County the following year. The St. Louis County occurrence near Gilbert has never been located again. It is also questionable whether Lake County location has been located again, in part due to a disputed herbarium label data. Bog muhly subsequently went undocumented in the state until 1987, when it was discovered on the sandy beaches of a lake in the BWCAW. As of 2009, approximately 25 occurrences have been reported, many of which are within 5 miles of each other.

In Minnesota, bog muhly occurs in wetlands and is considered to be a wetland obligate species. It occurs along sandy-gravel shores or cobbly organic shores, in seasonal basins, in peaty depressions, and on low hummocks in rich sedge fens. It is also known to occur in bogs, wet meadows, and lake shores in sandy or peaty, often acidic, soils.

Bog muhly has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Leiberg's waterlily (*Nymphaea leibergii*)

Leiberg's waterlily has a rather limited geographic range and is rare within its geographic range. It has been reported in Cook and Lake Counties and the BWCAW. This aquatic species was first discovered in Minnesota at Bald Eagle Lake (Lake County) in 1914. It was subsequently found at Mulligan Lake (Beltrami County) in 1949, Botany Bog (Itasca County) in 1977, and Stony Creek (Lake of the Woods County) in 1980. The species

was ultimately found in several rivers and streams in two major drainages within the sandy region of the Glacial Lake Agassiz basin, including the western branches of the Rapid River, which drains the Red Lake peatland.

The documented occurrences of Leiberg's waterlily in Minnesota are in shallow, protected bays in lakes and in slow-moving streams, especially streams impounded by beaver dams. One site is in a narrow outlet of a small pond surrounded by a graminoid poor fen. The plants are usually rooted in soft sediments beneath 3 to 7 feet of water, although the water is sometimes deeper. They prefer the outer margin of emergent vegetation, which typically consists of wild rice, arrowhead, bulrush, and cattail. The species frequently occurs with yellow pond-lily.

Leiberg's waterlily has not been reported on the federal or non-federal lands, or on the Tracks Project area.

American Waterawlwort (*Subularia aquatica* spp. *americana*)

American waterawlwort is a small, aquatic species that inhabits shallow water margins (typically 6 to 18 inches, sometimes as deep as 35 inches). It has a wide distribution in North America, although it is uncommon over most of its range. In Minnesota, it has been found primarily in the littoral zone of large, sandy, oligotrophic lakes in the northeast; there are a few occurrences from silty substrata in non-oligotrophic lakes in north-central Minnesota. When originally listed as state endangered in 1984, American waterawlwort was known from only six sites. Between 1984 and 2008, 11 additional populations were discovered. The majority of sites are in the Superior National Forest and the BWCAW, including in St. Louis, Lake, and Cook Counties.

American waterawlwort has not been reported on the federal or non-federal lands, or the Tracks Project area.

Bog White Violet (*Viola lanceolata* var. *lanceolata*)

Bog white violet (synonym: lance-leaved violet) occurs in low, moist meadows with a sandy substrate, moist swales in sand dunes and savannas, and occasionally on sandy lakeshores. One recent population was found on dry mud in an old beaver lodge. The majority of the original Minnesota populations probably occurred on the Anoka Sandplain in Sherburne, Isanti, and Anoka Counties. Recently, there have been discoveries of bog white violet in northeastern Minnesota in St. Louis and Lake Counties, including the BWCAW, where it appears to occur sporadically over a relatively large area (Milburn and Husveth 2004).

Bog white violet is typically found in habitats that have experienced some sort of disturbance event, which benefits this species due to its inability to compete with larger species. As competition for light and nutrients increases within the community, the size of the population decreases, and the population waits for the next disturbance event. Following a disturbance event, the species is adapted to quickly germinate from the seed bank or colonize an open area. The greatest threat to bog white violet is loss of habitat due to development, but fire suppression, altered hydrology, and invasive species can also negatively affect this species.

Bog white violet has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Habitat Conditions

There are approximately 4,164 acres of wetlands on the federal lands (**Table 8**). Although coniferous bog and coniferous swamp are the dominant wetland types, there are about 343 acres of non-forested wetland habitat (open bog, sedge/wet meadow, and shallow marsh) and 31 acres of open water associated with the federal lands,

or 6% of the federal lands, that could provide habitat for Habitat Group 1 RFSS. Nearly all of these wetlands are rated high for wetland quality (MDNR et al. 2013).

Mud Lake, the dominant open water feature on the federal lands, is within the One Hundred Mile Swamp. It is approximately 30.5 acres and has approximately 4,550 feet of shoreline. Yelp Creek flows out of One Hundred Mile Swamp to the Partridge River. The Partridge River flows through the northern, eastern, and southeastern portions of the federal lands. Collectively, Yelp Creek and the Partridge River are approximately 5.3 miles in length on the federal lands.

There are approximately 4,670 acres of wetlands on the non-federal lands (**Table 8**). Coniferous swamp and alder thicket or shrub-carr are the dominant wetland types, but there are also 124 acres of non-forested wetland habitat (open bog, sedge/wet meadow, and shallow marsh) and 182 acres of shallow, open water habitat on the non-federal lands, or 4% of the non-federal lands, that could provide habitat for Habitat Group 1 plant species. All wetlands on the non-federal lands are rated high for most wetland functions and values and wetlands on the non-federal lands share similar characteristics to those on the federal lands.

Several lakes and streams with associated riparian zone habitat are found on the non-federal lands. Hay Lake is on Hay Lake Lands and is approximately 96 acres with approximately 9,894 feet of shoreline. Little Rice Lake is also on Hay Lake Lands and is approximately 29 acres with approximately 4,830 feet of shoreline. An unnamed lake between Hay Lake and Little Rice Lake is approximately 4 acres with approximately 1,700 feet of shoreline. McFarland Lake Lands border McFarland Lake, with approximately 990 feet of shoreline along McFarland Lake. There are no other major lakes on the other non-federal lands.

Within Hay Lake Lands, the Pike River flows approximately 8 miles from the southern boundary to the northern boundary of the lands. Riparian habitat is found on both sides of the river for 5.7 miles and is found along one side of the river for 2.4 miles where the Pike River forms the boundary of Hay Lake Lands.

Coyote Creek begins on Wolf Lands 3, then flows north onto Wolf Lands 4 and beyond. The creek is approximately 0.1 mile long on Wolf Lands 3, and 0.9 mile long on Wolf Lands 4. Riparian habitat is found on both sides of the creek.

5.1.2.2 Direct and Indirect Effects

Proposed Action

Species Conditions

Federal Lands

Based on plant surveys of the federal lands, floating marsh marigold and quill spikerush would be directly affected by the Project. Moor rush has been found on the federal lands, but would not be affected by the Project. The remainder of Habitat Group 1 RFSS has not been reported on the federal lands.

Nine floating marsh marigold populations are near, but outside, the Mine Site and federal lands; five of these populations are found along the Partridge River. One population of floating marsh marigold would be directly affected by a Waste Rock Stockpile. The known statewide population for this species is rather small, the Project would affect about 8% of the known population in Minnesota.

Quill spikerush is primarily found in ditches along Dunka Road with gravel or sandy substrates. Of the 49 known populations in the state, 1 population would be affected by the Project (2% affected). An additional 13 populations are found along Dunka Road and the railroad tracks, but they are not on federal lands. The Project would have a direct effect on four of these populations. This species seems to be semi-tolerant of disturbance because it inhabits roadside ditches.

Moor rush has 30 known populations in the state, none of which occur on the Project area. One population, however, is found on the federal lands north of the Mine Site and within One Hundred Mile Swamp. This population would not be affected by the Project.

Non-federal Lands

No Habitat Group 1 RFSS have been reported on the non-federal lands. Under the Proposed Action, the non-federal lands would be transferred to the Forest Service, who would manage the lands for timber production, recreation, nature study, and other values. There would be no direct or indirect effects to Habitat Group 1 RFSS on the non-federal lands from the Project.

Habitat Conditions

Federal Lands

Direct effects to habitat for Habitat Group 1 RFSS on the federal lands would occur from habitat removal or destruction primarily from mining-related activities, including construction of the mine pits, Waste Rock Stockpiles, access roads, and mine facilities.

There are about 343 acres of non-forested wetland and 31 acres of open water within the federal lands that could provide habitat for Habitat Group 1 RFSS (**Table 8**). The Project would affect about 65 acres of non-forested wetland, but 0 acres of open water, or about 17% of the available habitat. The Project would not affect Mud Lake, the large open water area found within One Hundred Mile Swamp, or riparian zone habitat associated with Yelp Creek and the Partridge River.

Habitat for these species could be indirectly affected by dust from mining activities and vehicles, ore spillage, changes in surface and groundwater hydrology from groundwater drawdown, and from changes in water quality related to leakage from stockpiles/mine features and seepage from mine pits. These risks to Habitat Group 1 RFSS, however, should be negligible.

Non-federal Lands

There are about 124 acres of non-forested wetland (open bog, sedge/wet meadow, and shallow marsh) and 183 acres of open water within non-federal lands that could provide habitat for Habitat Group 1 RFSS (**Table 8**). Most of these habitats are found on Hay Lake Lands (263 acres; 86%). Smaller acreages of these habitats are found on Hunting Club Lands (16 acres) and Lake County Lands South (15 acres), with the remainder as scattered, small acreages on the other non-federal lands (**Table 8**). Under the Proposed Action, the Forest Service would survey for Habitat Group 1 RFSS prior to conducting land-disturbing activities and areas of known or potential habitat would be avoided when feasible.

Alternative B

Federal Lands

Effects to Habitat Group 1 RFSS and their habitats under Alternative B would be similar to those under the Proposed Action. Under Alternative B, there are about 291 acres of non-forested wetland (open bog, open water, sedge/wet meadow, and shallow marsh) and 9 acres of open water on the federal lands that could provide habitat for Habitat Group 1 RFSS (**Table 8**). About 74 fewer acres of open bog, open water, sedge/wet meadow, and shallow marsh habitats would be transferred to PolyMet under this alternative than under the Proposed Action, but direct and indirect effects to Habitat Group 1 RFSS species and habitats from the Project activities would remain the same as under the Proposed Action.

Non-federal Lands

Under Alternative B, only Hay Lake Lands would be transferred to the Forest Service. As discussed under the Proposed Action, no Habitat Group 1 RFSS have been reported on Hay Lake Lands. The Forest Service would acquire about 86 acres of non-forested wetland (open bog, open water, sedge/wet meadow, and shallow marsh) and 177 acres of open water habitats that are favored by Habitat Group 1 RFSS, or about 86% of the acreage the Forest Service would have obtained under the Proposed Action (**Table 8**). Effects on these species and their habitats from Forest Service and public use of Hay Lake Lands would be similar to those under the Proposed Action.

No Action Alternative

There would be no direct or indirect effects to Habitat Group 1 RFSS under the No Action Alternative.

5.1.2.3 Cumulative Effects

Timber harvesting, road building, and recreational activities are reasonably foreseeable future actions that could continue to occur on the federal lands and non-federal lands. In addition, there is the potential for homes and cabins to be built on the non-federal lands, including on small portions of wetlands, should the FEIS Record of Decision select the No Action Alternative and the non-federal lands remain under private ownership. These activities could affect the Habitat Group 1 RFSS within the CESA.

Forest management activities could result in Habitat Group 1 RFSS and their habitats being driven over and crushed by timber harvest and road construction/maintenance equipment, and harmed from sedimentation of streams and lakes due to ground disturbance. Timber harvest activities would be conducted during winter in wetlands, however, to reduce the risks of ground disturbance and sedimentation. Prior to implementing ground-disturbing activities, the Forest Service would conduct RFSS surveys to determine if RFSS would be affected by proposed activities. These surveys should help to ensure that RFSS species on non-federal lands are avoided, where feasible.

Lowland road construction and use and wetland draining are the two actions that probably have the largest effect on Habitat Group 1 RFSS within the CESA. Construction and use of roads in lowlands in the CESA, including construction of lowland roads for county, state, and private timber harvest, and for access to mineral exploration and production sites, recreation sites, and homesites, would continue to affect Habitat Group 1 RFSS habitat. However, the amount of suitable habitat affected by these activities should be small. In addition, timber harvest

on Forest Service and other ownerships would not affect this habitat appreciably because it is typically not forested with merchantable trees. The Forest Service would survey proposed timber harvest treatment areas for RFSS and would avoid areas with known or potential habitat for RFSS, where feasible.

Project activities on the federal lands would affect one population of quill spikerush. Project activities on adjacent private lands on the Mine Site would affect an additional four populations of quill spikerush and one population of floating marsh marigold. Approximately 65 acres of habitat could be directly affected on the federal lands that could be used by Habitat Group 1 RFSS. Despite the cumulative effects of the Project, habitat used by Habitat Group 1 RFSS that would be affected by the Project occurs elsewhere in the Superior National Forest, including the Tracks Project area, and would not be affected by the Project or other reasonably foreseeable future activities in the CESA. In addition, there are approximately 67,000 acres of open wetland and water habitat that could be used by Habitat Group 1 RFSS elsewhere in the CESA (Emmons and Olivier Resources, Inc. 2006:30, 38).

5.1.2.4 Summary

Project activities associated with the Proposed Action or Alternative B would have direct, indirect, and cumulative adverse effects on Habitat Group 1 RFSS and their habitat. Other activities in the CESA would contribute to cumulative effects for Habitat Group 1 RFSS. The Proposed Action and Alternative B would have similar effects on Habitat Group 1 RFSS, while there would be no effects to Habitat Group 1 RFSS from the No Action Alternative.

5.1.2.5 Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for floating marsh marigold, quill spikerush, moor rush, small beggarticks, linear-leaved sundew, auricled twayblade, bog muhly, American shoreweed, Leiberg's waterlily, American waterawlwort, or bog white violet. The No Action Alternative would have **no impact** on individuals of Habitat Group 1 RFSS.

5.1.2.6 Mitigation and Recommendations

Mitigation measures for Habitat Group 1 RFSS could include the following:

- Reseed Mine Site and Plant Site impact areas with native species, provided they can perform as effectively as the non-native species. In some areas where erosion control would be critical to prevent slope failures, non-native species may be needed. Temporary stabilization efforts using non-native species should use non-invasive plant species to minimize the long-term risk to surrounding plant communities.
- In the event invasive non-native species are introduced, an additional mitigation measure would be to implement a monitoring and control program for invasive species (including noxious weeds) to ensure these species do not overtake surrounding native communities.
- Additionally, the purchase of an unprotected site with a population of the RFSS species *Caltha natans* should be assessed as mitigation.

5.1.3 Cliff, Talus Slope, and Exposed Rock Habitat (Habitat Group 2)

5.1.3.1 Environmental Baseline

Habitat Group 2 RFSS favor cliffs, talus slopes, and exposed rock habitat. The following Habitat Group 2 RFSS either occur on, and/or have suitable habitat on, the federal and/or non-federal lands —maidenhair spleenwort, largeleaf sandwort, sticky locoweed, and encrusted saxifrage. Habitat Group RFSS 2 habitats are very rare on the federal and non-federal lands. No Habitat Group 2 RFSS have been reported on the federal lands. Encrusted saxifrage has been found on McFarland Lake Lands.

Species Conditions

Maidenhair Spleenwort (*Asplenium trichomanes*)

Maidenhair spleenwort has been found in Cook and Lake Counties, primarily near the North Shore of Lake Superior, and on the BWCAW. Most populations of maidenhair spleenwort occur on moist, north- to east-facing cliffs, particularly on ledges and in crevices. It also occurs in talus at the base of cliffs. Some of the cliffs are associated with large lakes that may provide a needed, climate-modifying effect. At least two populations are known to occur in association with open, exposed southeast-facing cliffs where conditions are warmer, drier, and sunnier. Populations in these more exposed habitats grow in sheltered crannies of cobbly talus.

Maidenhair spleenwort has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Appalachian Clubmoss (*Huperzia appalachiana*)

Appalachian clubmoss may be locally common in moist, sheltered habitats on sandstone ledges. However, the species seems to be rare even where suitable habitat exists. Historic populations documented by herbarium specimens collected in Blue Earth County (1883), in Hennepin County (1902), in Lake County (1943), and in St. Louis County (1949) have presumably been destroyed by human activities. There are very few populations known to currently exist in Minnesota.

Prior to 2000, all Minnesota specimens had been collected from sandstone bluffs and ledges in southeastern Minnesota. Beginning in 2000, the species was found at a number of sites in northeastern Minnesota on diabase cliffs. Sites in the northeast are typically northerly facing, wooded habitats that are moist and well-shaded. Appalachian clubmoss has been found in St. Louis, Lake, and Cook Counties, primarily along the North Shore of Lake Superior, and on the BWCAW. Appalachian clubmoss is found on shelves and crevices on cliff/talus/rock outcrops, and shrub dominated talus piles.

Appalachian clubmoss has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Largeleaf Sandwort (*Moehringia macrophylla*)

In Minnesota, populations of largeleaf sandwort are found in Cook and Lake Counties. Only a few of the historic populations have been relocated, despite considerable effort. All evidence indicates that this is a very rare species with limited distribution and restrictive environmental needs. Furthermore, all known populations are small and occur in fragile habitats. Most of the documented sites of largeleaf sandwort in Minnesota occur on sheltered cliffs of slate and diabase in the Rove Formation. In these habitats, the plants grow in small rock

crevices where organic debris accumulates or where moss mats provide a suitable substrate. Populations are typically associated with cliffs having a northerly aspect, where they are often found near the cliff base on small shelves, cracks, and chutes.

Largeleaf sandwort has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Sticky Locoweed (*Oxytropis borealis* var. *viscida*)

In Minnesota, sticky locoweed (synonym: viscid locoweed) is restricted to a single cliff in Cook County. The population was originally discovered in 1938 and still persists. Such a small, isolated population is vulnerable to a variety of stochastic processes attributable to natural events and human-caused effects. For this reason, sticky locoweed was listed as an endangered species in Minnesota in 1996.

The Minnesota sticky locoweed population occurs on a single, north- to northwest-facing cliff face and at the top of the associated talus slope. Plants occur in both sunny and partially shaded conditions where there is little competition from typical forest species; this is similar to the habitat occupied by the species in the Rocky Mountains. This population is apparently a relic of a wider, preglacial distribution.

Sticky locoweed has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Encrusted Saxifrage (*Saxifraga paniculata*)

Encrusted saxifrage was first documented in Cook County, Minnesota in 1932, and has since only been reported in Cook County, including on the McFarland Lake Lands. Encrusted saxifrage is an arctic-alpine species that reaches the southern end of its range in Minnesota. It typically occurs in rock crevices and on ledges of shaded north-facing cliffs with bedrock of diabase, gabbro/diorite, basalt, or Rove Formation rocks. There is very little suitable cliff habitat for encrusted saxifrage in Minnesota, and threats to the species could include climate change, changes in the biotic community, and recreational exploration of vulnerable cliff faces.

Encrusted saxifrage was found on McFarland Lake Lands, presumably associated with rock outcrops along the western edge of the lands. It has not been reported on the federal lands, other non-federal lands, or the Tracks Project area.

Habitat Conditions

There is very little suitable habitat for Habitat Group 2 RFSS on most of the federal and non-federal lands. There are scattered rock outcrops on the federal lands, and on Hay Lake Lands, Hunting Club Lands, Lake County Lands North, and Lake County Lands South, but no cliffs or talus slopes. Thus, it is unlikely that Habitat Group 2 RFSS would be found on these lands. Cliffs with exposed rock that are about 100 feet high are found in the central portion of McFarland Lake Lands and encrusted saxifrage was reported to occur on the McFarland Lake Lands (MDNR 2006).

5.1.3.2 Direct and Indirect Effects

Proposed Action

Species Conditions

Federal Lands

No Habitat Group 2 RFSS have been reported on the federal lands, and there is very little suitable habitat on the federal lands. Thus, it is unlikely that Habitat Group 2 RFSS would be affected by the Project.

Non-federal Lands

The Forest Service would monitor encrusted saxifrage on McFarland Lake Lands, and seek to protect high quality habitat for this plant species. Under the Proposed Action, the non-federal lands would be transferred to the Forest Service, who would manage the lands for timber production, recreation, nature study, and other values. The Forest Service would monitor Habitat Group 2 RFSS use of these lands, and seek to protect high quality habitat for these species.

Habitat Conditions

Federal Lands

There are no cliffs or talus slopes, and only a few areas with exposed rock, on the federal lands (ENSR 2005, AECOM 2011a). At most, only a few acres of exposed rock would be affected by the Project on the federal lands. Suitable habitat for maidenhair spleenwort, largeleaf sandwort, and encrusted saxifrage could occur on exposed rock outcrops, but it is unlikely that these species would be found on the exposed outcrops. Mining would result in development of a mine pit and associated rock walls and overburden storage piles that would have some exposed rock. These areas could provide habitat for Habitat Group 2 RFSS in the future.

Non-federal Lands

There are scattered rock outcrops on Hay Lake Lands, Hunting Club Lands, Lake County Lands North, and Lake County Lands South, but no cliffs or talus slopes (AECOM 2011b, c). Cliffs with rock outcrops are found on McFarland Lake Lands and total about an acre. Encrusted saxifrage is found on McFarland Lake Lands. Under the Proposed Action, the Forest Service would survey for Habitat Group 2 RFSS and associated habitat prior to conducting land-disturbing activities and areas of known or potential habitat would be avoided when feasible.

Alternative B

Federal Lands

Direct effects to Habitat Group 2 RFSS and their habitats under Alternative B would be similar to those under the Proposed Action. Although exposed rock habitat has not been specifically identified on the federal lands, it likely comprises only a few acres, and is more common in the upland areas on the eastern portion of the federal lands surrounding with the Mine Site (AECOM 2011a).

Non-federal Lands

As discussed under the Proposed Action, no Habitat Group 2 RFSS have been reported on Hay Lake Lands. There are scattered rock outcrops on the lands that could be used by Habitat Group 2 RFSS, but no cliffs or talus slopes (AECOM 2011b). Effects on Habitat Group 2 RFSS and their habitats from Forest Service and public use of Hay Lake Lands would be similar to those under the Proposed Action.

No Action Alternative

There would be no direct or indirect effects to Habitat Group 2 RFSS under the No Action Alternative.

5.1.3.3 Cumulative Effects

As discussed in Section 4.5.2, there has been a cumulative loss of habitat for RFSS from mining, road construction, housing and commercial development, and other land development activities, and from forestry and other land management activities. It is possible that Habitat Group 2 RFSS and/or their habitat have been lost from past and ongoing activities in the CESA, and would be lost in the future from similar reasonably foreseeable future activities.

Although Habitat Group 2 RFSS are rare in Minnesota, populations have been found elsewhere in the Superior National Forest, and on McFarland Lake Lands, and typically occupy areas that are not susceptible to timber harvesting or road building or other development. Given that Habitat Group 2 RFSS have not been reported on the federal lands, and potential habitat for these species on the federal lands is limited to only a few acres, adverse cumulative effects associated with Project actions on federal lands should be negligible.

Under the Proposed Action, the non-federal lands would be transferred to the Forest Service, who would manage the lands for timber production, recreation, nature study, and other values. Prior to implementing ground-disturbing activities, the Forest Service would conduct RFSS surveys to determine if RFSS would be affected by proposed activities. These surveys should help to ensure that RFSS species found on non-federal lands are avoided, where feasible. Due to its proximity to McFarland Lake and several cabins, it is unlikely that the Forest Service would harvest timber or construct roads on McFarland Lake Lands. The steep terrain also makes the lands unsuitable for snowmobile and most recreational uses. Thus, risks to encrusted saxifrage from Forest Service and recreational uses would be negligible, although the plant could be harmed by plant collectors.

5.1.3.4 Summary

Project activities associated with the Proposed Action, Alternative B, or the No Action Alternative should have no direct and indirect adverse effects on individuals of Habitat Group 2 RFSS, and any adverse effects to potential habitat for these species would be limited to a few acres. Other activities in the CESA would also contribute to cumulative effects toward the RFSS plants of this habitat group. The Proposed Action and Alternative B would have similar effects on Habitat Group 2 RFSS, while there would be no effects on Habitat Group 2 RFSS from the No Action Alternative.

5.1.3.5 Determination

The Proposed Action, Alternative B, and the No Action Alternative would have **no impact** to individuals of maidenhair spleenwort, largeleaf sandwort, sticky locoweed, and encrusted saxifrage.

5.1.3.6 Mitigation and Recommendations

No mitigation measures are proposed for Habitat Group 2 RFSS.

5.1.4 Upland Disturbed, Barrens, or Early Successional Forest Habitat (Habitat Group 3)

5.1.4.1 Environmental Baseline

Habitat Group 3 RFSS favor upland disturbed, barrens, or early successional forest habitat. The following Habitat Group 3 RFSS either occur on, and/or have suitable habitat on, the federal and/or non-federal lands—common moonwort, Michigan moonwort, pale moonwort, ternate grapefern, least moonwort, Appalachian clubmoss, and roughfruit fairybells. Michigan moonwort, pale moonwort, ternate grapefern, and least moonwort have been found on the federal lands, and pale moonwort, ternate grapefern, and least moonwort would be directly affected by mining activities. No Habitat Group 3 RFSS have been reported on the non-federal lands.

Species Conditions

Common Moonwort (*Botrychium lunaria*)

Common moonwort is the most widespread of the moonworts and has been found in St. Louis and Cook Counties and several other counties in northern Minnesota, including on the Tracks Project area. Common moonwort appears to prefer open habitats such as gravelly banks, rocky ledges, and talus. It has also been found on open, sparsely vegetated habitats with grasses and scattered shrubs. Along the shore of Lake Superior, common moonwort has been found in fire-dependent forests among mosses and lichens. A Forest Service database reported the habitat for common moonwort as cool/moist conditions, along forest roads and trails, in open areas, lakeshores (sand dunes), and occasionally in forests. Common moonwort has also been reported on sandy soils of old log landings in jack and red pine woods (Chadde and Kudray 2001a and references cited therein).

Common moonwort has not been reported on the federal or non-federal lands.

Michigan Moonwort (*Botrychium michiganense* [*hesperium*])

Across its range, Michigan moonwort (synonym: western moonwort) generally prefers an open habitat and often is found on open early successional habitats that have been disturbed in the past, such as roadside ditches, tailings ponds, gravel pits, log landings, sandy gravel pits, and mine tailings within the Mesabi Iron Range of northeastern Minnesota, including on the federal lands and on the Tracks Project area. Plants have also been found on sand dunes. Soils are often sandy or gravelly. In Minnesota, Michigan moonwort appears to prefer open disturbed habitats. Element occurrence records in St. Louis, Lake, and Cook Counties list habitats as tailings ponds, gravel pits, ditches, an old log landing, and along a weedy roadside (Chadde and Kudray 2001b and references cited therein).

Plant surveys conducted in 2004 identified nine locations of Michigan moonwort within the federal lands. Three of the locations were found on the federal lands within the Mine Site, all of which would be affected by the Project. Six locations of Michigan moonwort were found on private lands within or near the Dunka Road and Utility Corridor (Johnson-Groh 2004); one of these populations would be affected by Project activities.

Michigan moonwort has also been found on the Tracks Project area. Michigan moonwort is sometimes found with other *Botrychium* species in Minnesota including matricary grapefern and pale moonwort.

Michigan moonwort has not been reported on the non-federal lands.

Pale Moonwort (*Botrychium pallidum*)

Pale moonwort (synonym: pale botrychium) was first identified in Minnesota in 1992 and new populations are documented each year in a variety of habitats across northern Minnesota. It occurs in open early successional habitats, log landings, roadsides, sandy gravel pits, and mine tailings within the Mesabi Iron Range of northeastern Minnesota, including on the federal lands and on the Tracks Project area.

This diminutive perennial fern emerges in the late spring, produces spores, and matures within 3 to 4 weeks. Like many of the moonworts, pale moonwort may be sensitive to changes in soil mycorrhizae, herbivory from introduced earthworms, vegetative cover (in other words [i.e.], increased vegetative competition and shading), soil moisture, or other environmental factors affecting suitable microhabitats (Chadde and Kudray 2013a and references cited therein).

Of the 101 known populations statewide, 5 populations totaling 12 individuals were found on the federal lands surrounding the Mine Site; all of these populations would be directly affected by the Project. One of these populations is located south of the West Pit, along the Dunka Road and Utility Corridor. The other four populations are located adjacent to Dunka Road. An additional six locations of pale moonwort were found on private lands immediately adjacent to the federal lands; three of these populations would be affected by Project activities.

Pale moonwort has not been reported on the non-federal lands.

Ternate Grapefern (*Botrychium rugulosum*)

Ternate grapefern (synonym: St. Lawrence grapefern) is a perennial semi-evergreen fern that occurs in the northern and southcentral portions of Minnesota. Relatively little is known about the overall distribution, genetics, and life history requirements of ternate grapefern. In northern Minnesota, ternate grapefern prefers partially shaded mine tailings, sandy coniferous forests and plantations, and shaded vernal pool margins in rich deciduous hardwood forests. It also occurs in wetland areas within habitats subject to past clearing or cultivation. Ternate grapefern is often found in small stands of five to ten individuals, though larger populations can also occur. Disturbance also likely plays an important long-term role in the proliferation of this species (Chadde and Kudray 2013b and references cited therein).

Of the 72 known extant populations in Minnesota, 7 populations totaling 39 individuals occur on the federal lands. One of the seven populations occurring on federal lands would be directly affected by the Project (1% affected). Two additional populations occur on private lands immediately adjacent to the federal lands, neither of which would be affected by Project activities.

Ternate grapefern has not been reported on the non-federal lands, but has been reported on the Tracks Project area.

Least Moonwort (*Botrychium simplex*)

Least moonwort (synonym: little grapefern) occurs throughout northern and central Minnesota. Least moonwort occurs in a variety of natural and disturbed habitats, including brushy fields (often with other species of *Botrychium*), moist or dry woods, edges of forested vernal pools and swamps, mine tailings, and edges of sand/gravel/exposed forest roads. Like the other *Botrychium* species, disturbance likely plays an important role in the proliferation of this species (Chadde and Kudray 2013c and references cited therein).

Of the 213 known populations statewide, 16 populations consisting of at least 354 individuals occur on federal lands within the Mine Site; all but one of these populations would be affected by the Project. There are an additional 19 populations on private lands along the Dunka Road, the railroad, and the transmission line ROW near the Mine Site; 7 of these populations would be affected by Project activities.

Least moonwort has not been reported on the non-federal lands, but has been reported on the Tracks Project area.

Roughfruit Fairybells (*Prosartes trachycarpa* (synonym = *Disporum trachycarpum*))

Roughfruit fairybells has been found near Pigeon River Cliffs in Cook County. The species favors semi-open jack pine forest with aspen, birch, and shallow rocky soils.

Roughfruit fairybells has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Habitat Conditions

Habitat Group 3 RFSS favor upland disturbed, barrens, or early successional ('young' in MIH) forest habitat. There are approximately 64 acres of disturbed habitat and 652 acres of grassland/shrubland on the federal lands, primarily associated with roads and mine exploration sites (**Table 7**). In addition, there are about 271 acres of early successional (young) upland forest habitat (MIH 1 and 5) on the federal lands (**Table 6**).

There are no disturbed areas and approximately 1,878 acres of grassland/shrubland on the non-federal lands (**Table 7**). In addition, there are about 622 acres of early successional upland forest (**Table 6**) that could provide habitat for Habitat Group 3 RFSS on the non-federal lands. Grassland/shrubland habitat is primarily found on Hay Lake Lands and Lake County Lands South, while early successional upland forest is found on Hay Lake Lands, Hunting Club Lands, Lake County Lands North, and Wolf Lands 3.

5.1.4.2 Direct and Indirect Effects

Proposed Action

Species Conditions

Federal Lands

Based on plant surveys of the federal lands, four Habitat Group 3 RFSS would be directly affected by the Project: Michigan moonwort, pale moonwort, ternate grapefern, and least moonwort. All four species have also been found on adjacent private lands along the Dunka Road and Utility Corridor.

Of the 35 populations of Michigan moonwort documented in Minnesota, 3 populations totaling 11 individuals have been found on the federal lands within the Mine Site. Six additional populations totaling 255 individuals have been found on adjacent private lands along the Dunka Road and/or near the railroad tracks. The three populations on federal lands would all be directly affected (9% of statewide populations affected), with one population each being removed by pit excavation, haul road construction, and water pipeline construction. One of the six populations on private lands would be directly affected by Project activities.

Of the 101 known populations of pale moonwort in Minnesota, 5 populations totaling 12 individuals were found on federal lands surrounding the Mine Site. All five populations would be directly affected by the Project, including four locations along Dunka Road (5% of statewide populations affected). Six additional populations totaling 88 individuals were found on adjacent private lands along Dunka Road. Project activities would directly affect three of the six populations. This species, however, appears to be semi-tolerant of disturbance. Therefore, colonies may actually expand into newly disturbed areas along Dunka Road and at the Mine Site (MDNR et al. 2013).

Of the 72 known extant populations of ternate grapefern in Minnesota, 1 population with 19 individuals would be directly affected by construction of the East Pit (1% of statewide populations affected). Six additional populations of ternate grapefern were found within the federal lands, but would not be affected by the Project. Two populations of ternate grapefern, totaling six individuals, were found on private lands along Dunka Road south of the Ore Surge Stockpile and Category 2/3 Stockpile. The Project would have no effect on these two populations.

Of the 213 known populations of least moonwort in Minnesota, 16 populations with at least 356 individuals occur on the Mine site and all but one would be directly affected by mining activities. These include seven populations from stockpiles and mine pits, five populations from haul roads, two populations from water pipelines, and one population from other Project features (7% of statewide population affected). The populations affected by stockpiles, mine pits, and haul roads would be removed, while the populations affected by construction of pipelines or ditches may be reduced in numbers in the short term. Another 19 populations of least moonwort, totaling at least 1,424 individuals, are on adjacent private lands along Dunka Road and the railroad tracks in the vicinity of the Mine Site. The Project would have a direct effect on 7 of the 19 populations on adjacent private lands. Depending on proximity to construction activities, most of these populations of least moonwort would likely recover by growing along the Dunka Road and at the Mine Site post-closure, as this species appears to be semi-tolerant of disturbance (MDNR et al. 2013).

Non-federal Lands

No Habitat Group 3 RFSS have been reported on the non-federal lands, although many of these species were found on the Tracks Project area, which is near Lake County Lands and Wolf Lands. Under the Proposed Action, the non-federal lands would be transferred to the Forest Service, who would manage the lands for timber production, recreation, nature study, and other values. The Forest Service would monitor Habitat Group 3 RFSS use of these lands, and seek to protect high quality habitat for these species.

Habitat Conditions

Federal Lands

Direct effects to Habitat Group 3 RFSS habitat on the federal lands would occur from habitat removal or destruction primarily from mining-related activities, including construction of the mine pits, Waste Rock Stockpiles, access roads, or other mine facilities.

There are 64 acres of disturbed areas and 652 acres of grasslands and shrublands on the federal lands that could provide habitat for Habitat Group 3 RFSS (**Table 7**). The Project would affect about 14 acres of disturbed areas and 204 acres of grasslands and shrublands. In addition, about 260 acres of young upland forest habitat (MIH 1 and 5) would also be lost to mining (**Table 6**).

Habitat for these species could be indirectly affected by dust from mining activities and vehicles, ore spillage, changes in surface and groundwater hydrology from groundwater drawdown, and from changes in water quality related to leakage from stockpiles/mine features and seepage from the mine pits. These risks to Habitat Group 3 RFSS, however, should be negligible.

About 614 acres of grassland/shrubland habitat would be restored during mine reclamation (MDNR et al. 2013). Any remaining individuals in affected portions of the Project area could colonize this habitat. Although the biology of these *Botrychium* species is poorly understood, past mine development activities similar to those proposed by the Project have resulted in creation of habitat conditions favorable to the establishment of several *Botrychium* species, including several RFSS *Botrychium* species. These favorable habitat conditions may perpetuate any populations of these species that may have been missed during Project inventories (USDA Forest Service 2010b).

Non-federal Lands

There are no acres of disturbed habitat and about 1,878 acres of grassland/shrubland that that could provide habitat for Habitat Group 3 RFSS on the non-federal lands (**Table 7**). In addition, there are about 622 acres of early successional upland forest (MIH 1 and 5) that could provide habitat for Habitat Group 3 RFSS on the non-federal lands (**Table 6**). Much of this Habitat Group 3 RFSS habitat is found on Hay Lake Lands. There is no suitable Habitat Group 3 RFSS habitat on the other non-federal lands, although Appalachian clubmoss is found on shelves and crevices on cliff/talus/rock outcrops, which occurs on McFarland Lake Lands. Under the Proposed Action, the Forest Service would survey for Habitat Group 3 RFSS and associated habitat prior to conducting land-disturbing activities and areas of known or potential habitat would be avoided when feasible. Most recreational activity would be confined to trails and roads and could affect Habitat Group 3 RFSS that favor open, disturbed habitats.

Alternative B

Federal Lands

Direct effects to Habitat Group 3 RFSS under Alternative B would be similar to those under the Proposed Action. Based on plant surveys of the federal lands, the four Habitat Group 3 RFSS that could be directly affected by the Project under Alternative B are Michigan moonwort, pale moonwort, ternate grapefern, and least moonwort.

Direct effects to upland disturbed, barrens, or early successional forest habitat from mining and related activities would be similar for the Proposed Action and Alternative B. Under Alternative B, there are 29 acres of disturbed habitat and 439 acres of grassland/shrubland that could provide habitat for Habitat Group 3 RFSS (**Table 7**). In addition, there are about 271 acres of early successional upland forest (MIH 1 and 5) that could provide habitat for Habitat Group 3 RFSS on the non-federal lands (**Table 6**). About 35 fewer acres of disturbed habitat, 213 fewer acres of grassland/shrubland habitat, and the same number of acres of early successional upland forest habitat would be transferred to PolyMet from the Forest Service under Alternative B than under the Proposed Action.

Non-federal Lands

No Habitat Group 3 RFSS have been reported on Hay Lake Lands. There are no acres of disturbed habitat and 1,697 acres of grassland/shrubland that could provide habitat for Habitat Group 3 RFSS on Hay Lake Lands (**Table 7**). In addition, there are about 534 acres of early successional upland forest (MIH 1 and 5) that could provide habitat for Habitat Group 3 RFSS on Hay Lake Lands (**Table 6**). About 86% of early successional upland forest habitat that occurs on the non-federal lands is found on Hay Lake Lands. Thus, the Forest Service would receive much of the land that could provide habitat for Habitat Group 3 RFSS on the non-federal lands under both the Proposed Action and Alternative B.

No Action Alternative

There would be no direct or indirect effects to Habitat Group 3 RFSS under the No Action Alternative.

5.1.4.3 Cumulative Effects

As discussed in Section 4.5.2, it is possible that Habitat Group 3 RFSS and/or their habitat have been lost from past and ongoing activities in the CESA, and would be lost in the future from similar reasonably foreseeable future activities.

The Project could directly affect 35 Habitat Group 3 RFSS populations and about 478 acres of habitat used by Habitat Group 3 RFSS, on the federal lands. Despite the cumulative effects of the Mine Site, Habitat Group 3 RFSS species that would be affected by the Project occur elsewhere in the Superior National Forest, including the Tracks Project area, and in Minnesota, and would not be affected by the Project or other ground-disturbing activities in the CESA. In addition, there are about 33,000 acres of grassland habitat in the CESA (Emmons and Oliver Resources, Inc. 2006:30, 38). About 7% of Forest Service-administered lands are young forest (USDA Forest Service 2011:42), while the percentage of forestlands that are young forest is likely greater for privately owned lands. However, based on a conservative assumption that about 5% of upland forest in the CESA is young forest, about 31,000 acres of early successional upland forest would be available Habitat Group 3 RFSS. In addition, there are about 100,000 acres of disturbed mining areas, some of which could provide habitat for Habitat Group 3 RFSS in the CESA (Emmons and Oliver Resources, Inc. 2006:30, 38).

After mining, about 397 acres would be reclaimed and the federal lands would be privately owned and closed to public access (MDNR et al. 2013). Habitat Group 3 RFSS favor disturbed areas and early successional habitats, the types of habitat associated with recent logging and road-building activity. There is potential for mining activities and mine reclamation to create disturbed areas and early successional habitats that could be colonized by Habitat Group 3 RFSS in the future.

Timber harvesting, road building, and recreational activities could occur on the federal and non-federal lands. Forest management activities could result in Habitat Group 3 RFSS and their habitats being driven over and crushed by timber harvest and road construction/maintenance equipment. No Habitat Group 3 RFSS have been reported on the non-federal lands, but there are about 622 acres of suitable habitat (young age class; **Table 6**) on the lands. The Forest Service would survey for RFSS prior to conducting land-disturbing activities, and would avoid areas with known or potential habitat for RFSS when feasible. Should disturbance activities occur on the non-federal lands, it would result in soil disturbance and creation of early successional habitat that could be colonized by Habitat Group 3 RFSS.

5.1.4.4 Summary

Project activities associated with the Proposed Action and Alternative B would have direct, indirect, and cumulative effects on Habitat Group 3 RFSS, and cause adverse effects on up to 478 acres of known or potential habitat for Habitat Group 3 RFSS on the federal lands. Other activities in the CESA would also contribute to cumulative effects toward the RFSS plants of this habitat group. The Proposed Action and Alternative B would have similar effects on Habitat Group 3 RFSS, while there would be no effects to Habitat Group 3 RFSS from the No Action Alternative.

5.1.4.5 Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for Michigan moonwort, pale moonwort, ternate grapefern, least moonwort, common moonwort, Appalachian clubmoss, and roughfruit fairybells. The No Action Alternative would have **no impact** to individuals of Habitat Group 3 RFSS.

5.1.4.6 Mitigation and Recommendations

No mitigation measures are proposed for Habitat Group 3 RFSS.

5.1.5 Forested Wetland – Black Spruce, Tamarack, and Mixed Conifer Forest Habitat (Habitat Group 4)

5.1.5.1 Environmental Baseline

Habitat Group 4 RFSS favor forested wetlands comprised of coniferous trees such as black spruce, tamarack, and northern white cedar, and deciduous trees such as black ash and yellow birch. The following Habitat Group 4 RFSS either occur on, and/or have suitable habitat on, the federal and/or non-federal lands—fairy slipper, ram's head lady slipper, Selwyn's scalewort, yellow specklebelly, cartilage lichen, cloudberry, peppered moon lichen, honeycombed lichen, western Jacob's-ladder, snowline wintergreen, beard lichen, and two unnamed lichens, *Caloplaca parvula*, and *Cetraria aurescens*. Snowline wintergreen has been found on the federal lands. No Habitat Group 4 RFSS have been reported on the non-federal lands.

Species Conditions

Fairy Slipper (*Calypso bulbosa* var. *occidentalis*)

Fairy slipper is palearctic in distribution, and occurs in 20 of the 48 contiguous states and all of the Canadian provinces. It occurs across the northern third of Minnesota, including St. Louis, Lake, and Cook Counties. It is principally associated with northern white cedar, growing in the shaded duff with little or no herbaceous competition over a metamorphic and igneous bedrock parent material, with calcium accumulated from ground springs (Schmidt 2003a and references cited therein). In bogs, it can occur on stumps, logs, hummocks of drier soil, or slopes, but does not occur in soggy soils. Fairy slipper is also found in closed canopy forest with at least 60% cover and cool soils, and is intolerant of soil temperatures higher than 60 degrees Fahrenheit.

Fairy slipper requires older, closed-canopy cedar stands, so any loss of a viable cedar type affects this species. Limited regeneration due to high deer populations is the primary threat to the cedar community and associated species. Other threats to the community include beaver activity and forest harvesting.

Fairy slipper has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Ram's head Lady Slipper (*Cypripedium arietinum*)

Ram's head lady slipper ranges from Quebec and Saskatchewan south to Maine, New Hampshire, Vermont, Connecticut, and New York, and west to Michigan, Wisconsin, and Minnesota. Ram's head lady slipper has always been considered biologically rare in Minnesota, and the reasons for its rarity are not entirely known. It is known from St. Louis, Lake, and Cook Counties, and elsewhere in central and northern Minnesota. Recently, however, it has suffered a general decline in Minnesota largely as a result of habitat loss from changes in land use, including clear-cutting of jack pine forests.

In Minnesota, populations of Ram's head lady slipper occur in a variety of coniferous forest habitats. Several populations occur in swamps, bogs, or lowland forests dominated by northern white cedar, tamarack, balsam fir, or black spruce. Cool soils seem to define its range; in its southernmost reaches the orchid is found in cold bogs or north-facing cool bluffs near the Great Lakes where cool air drains down ravines. The species also occurs in the drier upland coniferous forests that may be dominated by white pine, red pine, or jack pine (Brzeskiewicz 2000 and references cited therein).

Ram's head lady slipper has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Selwyn's Scalewort (*Frullania selwyniana*)

Selwyn's scalewort is found on lowland northern white cedar swamps on the bark of northern white cedar.

Selwyn's scalewort has not been reported on the federal or non-federal lands, but has been found on the Tracks Project area.

Honeycombed Lichen (*Menegazzia terebrata*)

In the Great Lakes Region, honeycombed lichen has a scattered distribution, mainly associated with bog and cedar swamps, perhaps revealing its oceanic (moist oceanic forests) origin (USDA Forest Service 2002 and references cited therein). In the Great Lakes Region, honeycombed lichen survives in the oldest and wettest

ANALYSIS AND DETERMINATION OF EFFECTS

northern white cedar bogs as a few scattered individuals on cedar trunks (estimated 200+ years) in relatively open areas with 50 to 60% canopy cover. In Minnesota, five sites were found on the Superior National Forest within interior portions of old growth northern white cedar bogs. The main short term threat in northern white cedar bogs/swamps is hydrological change from road building and logging.

Honey-combed lichen has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Western Jacob's-ladder (*Polemonium occidentale* spp. *lacustre*)

Western Jacob's-ladder was first documented in St. Louis County, Minnesota in 1944. Prior to that discovery, this subspecies was unknown to science. A total of only five sites in Itasca and St. Louis Counties, Minnesota, have been located since 1944, even after extensive survey efforts.

Habitat requirements for western Jacob's-ladder include open forested wetland communities with associated northern white cedar, tamarack, black spruce, and generally a ground cover of sphagnum moss. Common associated shrub species include speckled alder and bog birch. Within suitable forests, western Jacob's-ladder is found on open and sparsely forested portions of the swamps, as well as in moderately deep shade, usually on hummocks of sphagnum moss. The saturated conditions usually originate from groundwater seepage.

Likely threats would include increased canopy closure, any activity that directly alters the habitat and destroys plants (e.g. slash piles, peat mining, and flooding by beaver dams), or anything that alters groundwater flow. All known locations of this species have a history of logging, ranging from disturbance in the early 1900s to as recent as the 1990s. In all five known populations, western Jacob's ladder blooms most in natural or logging-related openings. In contrast to other species associated with northern white cedar communities, logging appears to be less of a threat (Schmidt 2003b and references cited therein).

Western Jacob's ladder has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Snowline Wintergreen (*Pyrola minor*)

Snowline wintergreen (synonym: small shinleaf) is listed as a species of special concern in Minnesota. The species was first reported in Lake County in 1914 near the North Kawishiwi River. It has since only been documented in Cook, St. Louis, Lake, and Carlton Counties.

Snowline wintergreen is a circumpolar species occurring across Canada and the western U.S. in boreal and alpine habitats. It usually occurs in conifer swamps, including black spruce and northern white cedar swamps, and black spruce-balsam fir forests. Snowline wintergreen can also be found along moist ecotones between wetlands and uplands or between streams and slopes. It may be semi-tolerant of disturbance, because healthy populations exist along well-traveled portage routes and at sites that have experienced timber harvesting around 20 years prior.

Snowline wintergreen has been reported southwest of Mud Lake on the federal lands, within One Hundred Mile Swamp, and approximately 0.7 mile northwest of the Mine Site. Snowline wintergreen has also been found on the Tracks Project area.

Snowline wintergreen has not been reported on the non-federal lands.

Yellow Specklebelly (*Pseudocyphellaria crocata*)

Yellow specklebelly has always been rare in northern Minnesota. It was collected between 1897 and 1902 in St. Louis, Koochiching, Lake, and Cook Counties. In the last 34 years, it has been found only once in St. Louis County, approximately 65 miles northwest of the federal lands. The extensive removal of mature, moist forests across Minnesota's forested landscape has seriously reduced the occurrence of this lichen in the state.

Yellow specklebelly is found in habitats that are moist, shady, and often foggy. Substrates for this lichen are varied, including mossy rocks and a variety of trees, especially northern white cedar in mature hardwood and coniferous forests. When found on trees, this lichen usually occurs 3 to 4 feet above the ground and is at least partially shaded by the tree on which it is growing. All known Minnesota populations of this lichen are near water, and many are on offshore islands.

Yellow specklebelly has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Cartilage Lichen (*Ramalina thrausta*)

Cartilage lichen is found in old growth and other northern white cedar swamps.

Cartilage lichen has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Cloudberry (*Rubus chamaemorus*)

Cloudberry is an arctic and boreal species that is typical of circumpolar bog habitats in North America, Europe, and Asia. The southern limit of its range in North America is poorly defined and is represented by local and discontinuous populations in northern New England and disjunctive sites at Montauk Point, Long Island, and northeastern Minnesota. This species was unknown in Minnesota until 1954 when it was discovered near a research facility on Basswood Lake in the Superior National Forest in Lake County. Since that time, only a few colonies have been located despite targeted surveys. It has been found in St. Louis, Lake, and Cook Counties.

In Minnesota, cloudberry has been found in sphagnum bogs dominated by black spruce or mixed forests of black spruce speckled alder, bog birch, and sometimes northern white cedar. It is often found on deep sphagnum moss hummocks associated with bluejoint, three-seeded bog sedge, creeping snowberry, Labrador tea, and three-leaved false Solomon's seal.

Cloudberry has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Peppered Moon Lichen (*Sticta fuliginosa*)

Peppered moon lichen (synonym: spotted felt lichen) was formerly quite common in Minnesota along the Lake Superior shoreline and around inland lakes and bogs. Today, there are only a few extant populations known in Cook, Lake, and St. Louis Counties; none of these sites are near the federal or non-federal lands. Where it exists, it is found on conifer and hardwood trees in mature, moist forests and bogs. Yellow birch and northern white cedar are preferred substrates. This lichen prefers partial shade in areas that tend to retain moisture, such as northern white cedar swamps, and is often growing on the lower trunks of trees, 3 to 5 feet above the ground (Whitmore 2002a and references cited therein).

Peppered moon lichen has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Beard Lichen (*Usnea longissima*)

Beard lichen is known in Michigan, Wisconsin, and Minnesota. In Minnesota, it has been found in St. Louis, Lake, and Cook Counties, primarily near Lake Superior and in the BWCAW.

Beard lichen is usually found in forests near streams, lakes, or in bogs. The forests are balsam fir, black spruce, or northern white cedar over 100 years old that may be open or quite shady. High humidity and habitat continuity are important for growth, but this species grows better on the upper branches of trees where there is more available light. The recent localities in Superior National Forest are undisturbed balsam fir or northern white cedar stands near water. In one locality (Mark Creek), it apparently began growth in a mature balsam fir forest that has since been killed by insects but the thallus persisted on a dead balsam fir. The extensive logging in the past has eliminated many potential habitats (Wetmore 2002b and references cited therein).

Beard lichen has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Lichen spp. (*Caloplaca parvula*)

Caloplaca parvula was unknown to science when this species was first collected in Minnesota in 1978 near Kettle Falls in St. Louis County. Only two additional specimens have been found in the state since then, both in St. Louis County on Little Long Lake and Echo Lake on the Superior National Forest (Wetmore 2002c and references cited therein). This lichen species occurs in old-age, deciduous-tree swamps, specifically black ash bogs, near open water. In Minnesota, all sites were open black ash bogs with some standing water and without tall grasses, sedges, or brush. These swamps typically have 12 to 14 inches dbh trees, but this lichen species is not found on these trees. Instead, the preferred substrate is 3 to 4 inches dbh young re-growth, near the tree base, within 1 foot of the ground. The forest canopy is fairly open, allowing for lots of sunlight. Humidity in these habitats is high. Groundcover is minimal, typically comprised of just a few sedges.

Caloplaca parvula does not occur on sites with abundant shrubs and groundcover. It is found on sites with some amount of standing water, but has never been found other on a site without standing water. Water is in depressions in the swamp. The young trees or regrowth on which this species is found may themselves be in standing water. All Minnesota sites could be potentially threatened by permanent lake level changes caused by addition or removal of dams (Wetmore 2002c and references cited therein).

Caloplaca parvula has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Lichen spp. (*Cetraria aurescens*)

Cetraria aurescens occurs in old-growth temperate forests and usually grows on pine, on cedar, and occasionally on hardwoods in the southern Appalachians. It has been found in St. Louis, Lake, and Cook Counties, including about 6 miles south of Hoyt Lakes and 5 miles east of Babbitt, Minnesota.

In northern Minnesota, it is restricted to moist habitats near bogs or water in areas of old-growth forest without disturbance, especially within northern white cedar swamps over 100 years old. In the Great Lakes Region, this species seems to require old-growth, moist habitats. In a habitat study in Superior National Forest, this species was found in forest stands with an overstory ranging from 10 to 80% and on trees ranging in age from 118 to

266 years. These localities were usually northern white cedar swamps or black spruce bogs (Wetmore 2002d and references cited therein).

Cetraria aurescens has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Habitat Conditions

Habitat Group 4 RFSS favor forested wetlands comprised of coniferous trees such as black spruce, tamarack, northern white cedar, and deciduous trees such as black ash and yellow birch. Several species, including bearded lichen, fairy slipper, and *Cetraria aurescens* prefer mature wetland forest habitat. Although forested wetland habitat is the most common habitat on the federal and non-federal lands, only one species, snowline wintergreen, was found on the federal lands, and only two species, snowline wintergreen and Selwyn's scalewort, were found on the Tracks Project area; none of the Habitat Group 4 RFSS were reported on the non-federal lands.

There are about 3,270 acres of forested wetland on the federal lands, which represents 79% of all wetland habitat and 50% of all habitat on these lands (**Table 8**). Snowline wintergreen was found within One Hundred Mile Swamp, which is dominated by black spruce, northern white cedar, and tamarack forest, with small patches of open bogs and shrublands. Sphagnum and club mosses cover nearly 100% of the ground, while forest and shrub cover is about 40 to 70%. ENSR (2005) found that about 1% of wetland forest is comprised of young trees, 93% is comprised of immature trees, while about 5% is comprised of mature trees. Of this acreage, only 1% is comprised of deciduous or mixed coniferous-deciduous forest, the remainder was black spruce, northern white cedar, or tamarack forest.

There are about 3,300 acres of forested wetland on the non-federal lands, which represents 71% of all wetland habitat and 47% of all habitat on these lands (**Table 8**). Wetland forest is dominated by black spruce and tamarack, with scattered northern white cedar. Forest and shrub cover ranges from 30 to 60%, while ground cover is 50 to 90% (AECOM 2011b, c). AECOM (2011b, c) found that less than 1% of wetland forest is comprised of mature trees, 4% is comprised of young trees, while 95% is comprised of immature trees. Of this acreage, only 3% is comprised of deciduous or mixed coniferous-deciduous forest, the remainder was black spruce, northern white cedar, and tamarack forest. Black ash is found in small patches on Lake County Lands South, Hunting Club Lands, and Wolf Lands 2, while northern white cedar is most common on Lake County Lands North, Lake County Lands South, Wolf Lands 2, and Wolf Lands 4.

5.1.5.2 Direct and Indirect Effects

Proposed Action

Species Conditions

Federal Lands

Based on plant surveys of the federal lands, one population of snowline wintergreen, consisting of ten individuals, was found northwest of the Mine Site within One Hundred Mile Swamp. The remainder of Habitat Group 4 RFSS have not been reported on the federal lands. The Project would have no direct or indirect effect on the snowline wintergreen population in One Hundred Mile Swamp.

Non-federal Lands

No Habitat Group 4 RFSS have been reported on the non-federal lands. Under the Proposed Action, the non-federal lands would be transferred to the Forest Service, who would manage the lands for timber production, recreation, nature study, and other values. The Forest Service would monitor Habitat Group 4 RFSS use of these lands, and seek to protect high quality habitat for these species.

Habitat Conditions

Federal Lands

Direct effects to Habitat Group 4 RFSS on the federal lands could occur from mining-related activities, including construction of the mine pits, Waste Rock Stockpiles, access roads, and mine facilities. Although no Habitat Group 4 RFSS were found during plant surveys for the federal lands, about 589 acres of forested wetland would be directly affected by mining on the federal lands (**Table 8**).

Habitat for snowline wintergreen, which is found northwest of the Mine Site, and other Habitat Group 4 RFSS, could potentially be indirectly affected by dust from mining activities and vehicles, changes in surface and groundwater hydrology from groundwater drawdown, and from changes in water quality related to leakage from stockpiles/mine features and seepage from mine pits (MDNR et al. 2013). These risks, however, should be negligible.

About 516 acres of wetland habitat would be restored during mine reclamation (MDNR et al. 2013). However, it is unlikely that any Habitat Group 4 RFSS would colonize these areas because nearly all Habitat Group 4 RFSS prefer immature and mature forests and it would likely be 20 or more years before the restored habitat would reach this stage of maturity.

Non-federal Lands

There are about 3,300 acres of forested wetland, or 71% of all wetland habitat and 47% of all habitat, on the non-federal lands (**Table 8**). Under the Proposed Action, the Forest Service would survey for Habitat Group 4 RFSS and associated habitat prior to conducting land-disturbing activities; areas of known or potential habitat would be avoided when feasible. Most recreational activity would be confined to trails and roads and could affect Habitat Group 4 RFSS that favor open, disturbed habitats.

Alternative B

Federal Lands

Direct and indirect effects to Habitat Group 4 RFSS under Alternative B would be similar to those under the Proposed Action. Based on plant surveys for the federal lands, no Habitat Group 4 RFSS would be directly affected by the Project under Alternative B.

Direct and indirect effects to forested wetlands from mining and related activities would be similar for the Proposed Action and Alternative B. Under Alternative B, there are about 2,167 acres of forested wetland (**Table 8**). About 1,103 fewer acres (34%) of forested wetland would be transferred to PolyMet from the Forest Service than under the Proposed Action.

Non-federal Lands

No Habitat Group 4 RFSS have been reported on Hay Lake Lands. There are about 1,962 acres of forested wetland on Hay Lake Lands, which is about 59% of the forested wetland habitat that occurs on the non-federal lands (**Table 8**). Thus, the Forest Service would receive lands that could provide habitat for Habitat Group 4 RFSS on the non-federal lands under Alternative B.

No Action Alternative

There would be no direct or indirect effects to Habitat Group 4 RFSS under the No Action Alternative.

5.1.5.3 Cumulative Effects

As discussed in Section 4.5.2, it is possible that Habitat Group 4 RFSS and/or their habitat have been lost from past and ongoing activities in the CESA, and would be lost in the future from similar reasonably foreseeable future activities.

Because European settlement, timber harvest, wetland drainage, and road construction have affected forested wetlands and reduced the amount and distribution of this habitat within the CESA. More recently, timber sales on federal, state, county, and private lands have changed the age class distribution of lowland black spruce habitats, but have not altered the overall suitability of the habitat for species in this habitat group.

Forest management activities could result in Habitat Group 4 RFSS and their habitats being driven over and crushed by timber harvest and road construction/maintenance equipment, and harmed from sedimentation of streams and lakes due to ground disturbance. Timber harvest activities would be conducted during winter in wetlands, however, to reduce the risks of ground disturbance and sedimentation.

Construction and use of roads in lowlands under the Proposed Action, Alternative B, and No Action Alternative and elsewhere in the CESA would continue to affect suitable habitat. However, the proportion of total suitable habitat affected by these activities would be very small. Timber sales affecting lowlands on state or county lands could change the age class of lowland black spruce forests in the Project area, temporarily making some stands less suitable for Habitat Group 4 RFSS. However, the proportion of total suitable habitat affected by these activities would be very small.

The Project could potentially indirectly affect the habitat of one Habitat Group 4 RFSS population, and directly affect about 589 acres of potential habitat on the federal lands for Habitat Group 4 RFSS (**Table 7**). Despite the potential cumulative effects, RFSS that could be affected by the Project also occur elsewhere in the Superior National Forest, including the Tracks Project area, and elsewhere in Minnesota, which would not be affected by the Project or other ground-disturbing activities in the CESA. In addition, there about 370,000 acres of habitat for Habitat Group 4 RFSS remaining in the CESA (Emmons and Olivier Resources, Inc. 2006:30, 38).

PolyMet would acquire about 2,266 acres of forested wetland on the federal lands surrounding the Mine Site under the proposed land exchange (**Table 8**). Although these lands would remain privately owned, it is likely that some or all of these lands would be managed for timber production and harvested in the reasonably foreseeable future. Timber harvest and associated road construction could directly or indirectly affect Habitat Group 4 RFSS, including snowline wintergreen, unless efforts are taken to avoid Habitat Group 4 RFSS. Effects

from timber management would be mitigated by voluntary adherence to Minnesota Forest Resources Council best management practices (Minnesota Forest Resources Council 1999).

Timber harvesting, road building, and recreational activities could occur on non-federal lands. No Habitat Group 4 RFSS have been reported on the non-federal lands, but there are about 3,300 acres of suitable habitat on the non-federal lands (**Table 8**). The Forest Service would survey for RFSS prior to conducting land-disturbing activities, and would avoid areas with known or potential habitat for RFSS when feasible. Should disturbance activities occur on the non-federal lands, it would take 20 or more years before disturbed lands would be suitable for Habitat Group 4 RFSS.

5.1.5.4 Summary

Project activities associated with the Proposed Action and Alternative B could have indirect effects on individual Habitat Group 4 RFSS, and indirect and cumulative effects on their habitat. Other activities in the CESA would also contribute to cumulative effects toward the RFSS plants of this habitat group. The Proposed Action and Alternative B would have similar effects on Habitat Group 4 RFSS, while there would be no effects to Habitat Group 4 RFSS from the No Action Alternative.

5.1.5.5 Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for snowline wintergreen, fairy slipper, ram's head lady slipper, Selwyn's scalewort, yellow specklebelly, cartilage lichen, cloudberry, peppered moon lichen, honeycombed lichen, western Jacob's-ladder, beard lichen, and two unnamed lichens, *Caloplaca parvula*, and *Cetraria aurescens*. The No Action Alternative would have **no impact** to individuals of Habitat Group 4 RFSS.

5.1.5.6 Mitigation and Recommendations

No mitigation measures are proposed for Habitat Group 4 RFSS.

5.1.6 Mesic Hardwood Forest Dominated Habitat (Habitat Group 5)

5.1.6.1 Environmental Baseline

Habitat Group 5 RFSS favor upland mesic (moderately moist) deciduous forests comprised of sugar maple, basswood, paper birch, and yellow birch. The following Habitat Group 5 RFSS either occur on, and/or have suitable habitat on, the federal and/or non-federal lands—moshatel, Braun's holly fern, triangle grapefern, and lanceleaf grapefern. Triangle grapefern has been found on Hay Lake Lands, but not on the other non-federal lands or federal lands. Moshatel, Braun's holly-fern, and lanceleaf grapefern have not been found on the federal or non-federal lands.

Species Conditions

Moshatel (*Adoxa moschatellina*)

The number of known occurrences of moshatel in Minnesota exceeds 120 populations, including records from St. Louis, Lake, and Cook Counties. The habitat of moshatel in Minnesota is primarily mesic hardwood forests. These are typically mature or old growth communities dominated by sugar maple and basswood. There may also

be significant amounts of paper birch and yellow birch. In the northern part of the state there may be conifers present, particularly northern white cedar and balsam fir.

The narrow geographical and ecological range of those occurrences may be a cause for concern. It appears that the mature mesic hardwood forests where this species occurs are often selectively targeted for intensive forest management in northern Minnesota. In addition to the pressures of the timber industry, mesic forests in southeastern Minnesota tend to be more vulnerable to invasion by non-native species.

Moshatel not been reported on the federal or non-federal lands, or on the Tracks Project area.

Triangle Grapefern (*Botrychium lanceolatum*) and Lanceleaf Grapefern (*Botrychium lanceolatum* var. *angustisegmentum*)

Lanceleaf grapefern is a variety of triangle grapefern and the two are analyzed together in this section. These are small ferns that range across much of the northeastern U.S. and Canada. They are uncommon in Minnesota, but more common in Wisconsin and Michigan, and especially common on the Ottawa National Forest in Michigan's western Upper Peninsula. They are found in St. Louis, Lake, and Cook Counties and several other counties in Minnesota, including on the Tracks Project area. They prefer moist, shady, mature northern hardwood forests, particularly in low areas. They usually occur with sugar maple, yellow birch, green ash, black ash, red oak, basswood, and sometimes northern white cedar. The understory can be rather open.

These ferns probably appear or disappear in accordance with mycorrhizal health due to their obligate relationship with the fungi. Environmental factors that may affect mycorrhizae, like reduction in water availability, are likely to have effects on these ferns, whereas the repeated removal of leaf tissue may have little effect (Chadde and Kudray 2001c and references cited therein).

Triangle grapefern not been reported on the federal lands, but one population was been found near the southwestern portion of Hay Lake Lands (MDNR 2014a). It was not reported on the Tracks Project area.

Lanceleaf grapefern has not been reported on the federal or non-federal lands, but was found on the Tracks Project area.

Goblin Fern (*Botrychium mormo*)

The geographic range of *Botrychium mormo* is confined to forests in portions of three contiguous states: Minnesota, Wisconsin, and Michigan. Most of the records are from north-central Minnesota, particularly Cass County. However, the species is scarce even within its stronghold, and it is becoming increasingly rare. The species requires an intact tree canopy in order to have consistently shaded, moist conditions and the accelerating rate of habitat degradation is the reason for its decline. Concerns over habitat loss and degradation from timber management activities and land clearing prompted the listing of *B. mormo* as a Minnesota special concern species in 1984.

B. mormo occurs in mature mesic hardwood forests where the dominant trees are *Acer saccharum* (sugar maple) with lesser amounts of *Thuja occidentalis* (northern white cedar). The canopy must be intact to maintain shaded, moist conditions. The soils are loamy with large amounts of humus, or organic matter, on the surface.

There is a documented occurrence of goblin fern within a mile of the Hay Lake parcel, where suitable habitat for goblin fern may be present.

Braun's Holly Fern (*Polystichum braunii*)

The geographic range of Braun's holly fern is quite limited and it is generally considered to be rare or local wherever it occurs. It was first found in Minnesota in 1966 during a geological survey of Cook County, and it has since been discovered in adjacent Lake County. Surveys of suitable habitats in northeastern Minnesota have located this species in only a few locations, and it typically occurs in rather localized, small populations.

Most occurrence records place the species in rocky environments, including in soil pockets and fissures in rock outcrops, at the bases of cliffs, among talus, along boulder-strewn water courses, or in rocky woods. But others have found it in environments that may be relatively rock-free, such as floodplain forests and woods with deep loamy soil. Microhabitat seems to be crucial in providing the cooler temperatures needed by this northern species. It is often found in erosion channels where the banks are steeply cut and cool air drains and settles, providing cool and moist conditions throughout the day. Shade, either of steep-sided ravines and gorges, north-facing slopes, or provided by a mature forest canopy or at least a shrub thicket, seems to be a constant. (Brzeskiewicz and Fields 2003 and references cited therein). In Minnesota, Braun's holly fern has been found on small ledges and cracks on the steep walls of river gorges, at the base of cliffs, on shaded rockslides, and in a cobbly, seepy drainage of lowland black ash and northern white cedar. However, most of the populations occur along moist, often rocky draws and ephemeral rocky streams in rich hardwood forests dominated by sugar maple and yellow birch.

Braun's holly fern has not been reported on the federal or non-federal lands, or the Tracks Project area.

5.1.6.2 Habitat Conditions

Habitat Group 5 RFSS favor upland mesic (moderately moist) deciduous forests comprised of sugar maple, basswood, paper birch, and yellow birch. Upland mesic deciduous forest is a component of MIH 1. However, the Forest Service MIH mapping system is too broad to accurately identify acres of this particular forest type. There are about 1,330 acres of upland forest (MIH 1), which includes aspen/aspen-white birch, maple/basswood, and oak forest cover types, on the federal lands and 2,695 acres of upland forest on the non-federal lands (**Table 6**). However, based on plant habitat surveys for the federal lands, mesic deciduous forest comprises only a small portion of upland deciduous forest on the federal and non-federal lands (MDNR et al. 2013).

5.1.6.3 Direct and Indirect Effects

Proposed Action

Species Conditions

Federal Lands

There should be no direct or indirect effects to moshatel, Braun's holly fern, triangle grapefern, or lanceleaf grapefern on federal lands from the Project as they have not been found on the federal lands and there is very little suitable habitat for these species on the federal lands.

Non-federal Lands

The Forest Service would monitor for triangle grapefern near Hay Lake Lands, and seek to protect high quality habitat for this plant species. Under the Proposed Action, the non-federal lands would be transferred to the Forest Service, who would manage the lands for timber production, recreation, nature study, and other values. The Forest Service would monitor Habitat Group 5 RFSS use of these lands, and seek to protect high quality habitat for these species.

Habitat Conditions

Federal Lands

There is very little suitable mesic upland forest habitat for Habitat Group 5 RFSS on the federal lands.

Non-federal Lands

Very little upland mesic upland forest habitat is found on the non-federal lands. Under the Proposed Action, the Forest Service would survey for Habitat Group 5 RFSS and associated habitat prior to conducting land-disturbing activities; areas of known or potential habitat would be avoided when feasible. Most recreational activity would be confined to existing trails and roads and would not likely affect Habitat Group 5 RFSS that favor upland mesic deciduous forests.

Alternative B

Federal Lands

There should be no direct or indirect effects to moshatel, Braun's holly fern, triangle grapefern, or lanceleaf grapefern on federal lands from the Project under Alternative B as these species have not been reported on the federal lands and there is little suitable mesic upland forest habitat for these species on the federal lands.

Non-federal Lands

Triangle grapefern has been found near Hay Lake Lands. Risks to this population and other Habitat Group 5 RFSS populations that could be found on the non-federal lands, and their habitat, would be similar to those under the Proposed Action.

No Action Alternative

There would be no direct or indirect effects to Habitat Group 5 RFSS under the No Action Alternative.

5.1.6.4 Cumulative Effects

As discussed in Section 4.5.2, it is possible that Habitat Group 5 RFSS and/or their habitat have been lost from past and ongoing activities in the CESA, and would be lost in the future from similar reasonably foreseeable future activities.

Forest management activities could result in Habitat Group 5 RFSS and their habitats being driven over and crushed by timber harvest and road construction/maintenance equipment, and from ground disturbance

associated with these activities. Timber harvest and road construction have affected upland forests and reduced the amount and distribution of this habitat within the CESA. Construction and use of roads under the Proposed Action, Alternative B, and the No Action Alternative, and elsewhere in the CESA, would continue to affect suitable habitat. There are about 460,000 acres of upland deciduous forest in the CESA (Emmons and Olivier Resources, Inc. 2006:30, 38), and a portion of this habitat would be mesic hardwood forest and would be available to Habitat Group 5 RFSS.

There should be no effects to Habitat Group 5 RFSS or their habitat from mining, and little upland mesic hardwood forest would be transferred to PolyMet under the land exchange (MDNR et al. 2013). Timber harvesting, road building, and recreational activities could occur on the federal and non-federal lands, depending upon whether the Proposed Action, Alternative B, or No Action Alternative is selected in the Record of Decision. In addition, there is the potential for homes and cabins to be built on the non-federal lands should the FEIS Record of Decision select the No Action Alternative and non-federal lands remain under private ownership. Only one population of triangle grapefern has been found on or near the non-federal lands (Hay Lake Lands) and little suitable habitat is found on the non-federal lands for Habitat Group 5 RFSS. The Forest Service would survey for RFSS prior to conducting land-disturbing activities, and would avoid areas with known or potential habitat for RFSS when feasible.

5.1.6.5 Summary

Project activities associated with the Proposed Action and Alternative B should have no direct or indirect adverse effects on Habitat Group 5 RFSS or their habitat, and would have a negligible contribution toward cumulative effects for Habitat Group 5 RFSS. Other activities in the CESA could also contribute to cumulative effects toward the RFSS plants of this habitat group. The Proposed Action and Alternative B would have similar effects on Habitat Group 5 RFSS, while there should be no effects to Habitat Group 5 RFSS from the No Action Alternative.

5.1.6.6 Determination

There would be **no impacts** to individuals of moshatel, Braun's holly fern, triangle grapefern, or lanceleaf grapefern under the Proposed Action, Alternative B, or No Action Alternative.

5.1.6.7 Mitigation and Recommendations

No mitigation measures are proposed for Habitat Group 5 RFSS.

5.1.7 Dry-mesic Upland Forest: Deciduous, Coniferous, or Mixed Forest Habitat (Habitat Group 6)

5.1.7.1 Environmental Baseline

Habitat Group 6 RFSS favor dry to mesic upland forests. The following Habitat Group 6 RFSS either occur on and/or have suitable habitat on, the federal and/or non-federal lands—New England sedge, fan lichen, Canada yew, Canada ricegrass, and barren strawberry. Fan lichen, although not included as part of any habitat group in the Forest Plan BE, is analyzed with this habitat group in this BE because of its affinity for bare soil habitats such as root wads (USDA Forest Service 2004c). None of these species have been reported on the federal or non-federal lands.

Species Conditions

New England Sedge (*Carex novae-angliae*)

New England sedge has been found at several locations in the Superior National Forest in St. Louis, Lake, and Cook Counties, including on the Tracks Project area. It is found in moist woods with sugar maple, paper birch, trembling aspen, yellow birch, and white spruce dominated forest (Shackleford 2004).

New England sedge has not been reported on the federal or non-federal lands. It has been found on the Tracks Project area.

Fan Lichen (*Peltigera venosa*)

In Minnesota, fan lichen has only been found in Cook County, where it grows on soil and on moist cliffs at a few locations near Lake Superior (Wetmore 2002e and references cited therein). In 1897, Bruce Fink found the species at two localities, while the most recent collections are from 2010. Thorough searches at many localities have yielded no additional records, but some potential habitat remains to be searched. The preferred substrate for fan lichen is rich, not-recently-disturbed soil and mossy rocks. It prefers cool, shady, moist locations, but only where there is little competition from other plants.

Fan lichen has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Canadian Ricegrass (*Piptatherum [=Oryzopsis] canadense*)

Canadian ricegrass is found in St. Louis, Lake, and Cook Counties. This species is known from only eight documented locations in Minnesota. It prefers gravelly/sandy soil associated with red and jack pine plantations.

Canada ricegrass has not been reported on the federal or non-federal lands, but has been found on the Tracks Project area.

Canada Yew (*Taxus canadensis*)

Canada yew is found in northern Minnesota, including St. Louis, Lake, and Cook Counties. Canada yew is a shrub found as an understory species in a wide variety of uplands and lowlands, including northern white cedar/black ash swamps, talus and cliffs, northern hardwoods, and trembling aspen/paper birch forest.

Canada yew has not been reported on the federal or non-federal lands, but has been found on the Tracks Project area.

Barren Strawberry (*Waldsteinia fragarioides*)

In Minnesota, barren strawberry is restricted to forested sites in the northeastern part of the state. The earliest collection of the species is from 1893 in Lake County. It was later collected by Olga Lake at several locations in St. Louis and Lake Counties between 1938 and 1956. Relatively few records were reported in the 1980s but since that time, over 30 observations have been documented, including on the Tracks Project area. Some of these observations are clustered, with sites within a few miles of each other. Separate observations may actually be part of one larger population. Taking this into consideration, there are probably just over 20 populations that have been observed in the state since 1990.

In Minnesota, barren strawberry grows both in fire-dependent forests and in dry mesic hardwood forests. It is often found in forests dominated by pine, including red pine, white pine, and jack pine. It is also found in mixed pine and hardwood forests, often with trembling aspen, as well as in hardwood forests dominated by sugar maple. It is sometimes observed growing in deep shade, but perhaps most often in woodlands with small openings or relatively open tree or shrub canopies. It is also found growing in full sun along roadsides (Hill 2003 and references cited therein).

Barren strawberry has not been reported on the federal or non-federal lands.

Habitat Conditions

Upland forest (MIH 1 and 5) is common on the federal and non-federal lands. There are about 2,582 acres of upland forest on the federal lands, and 2,774 acres of upland forest on the non-federal lands, that could provide habitat for Habitat Group 6 RFSS (**Table 6**). Coniferous forest (MIH 5) makes up about 49% of the upland forest habitat on the federal lands, but only 3% of upland forest on the non-federal lands (**Table 6**). Jack pine, trembling aspen, paper birch, black spruce, and balsam fir are the dominant upland forest species on the federal lands; there are also scattered stands of red and white pine (ENSR 2005, AECOM 2011a). These species are also common on the non-federal lands, although there is less jack pine and more eastern white pine on the non-federal lands than on the federal lands (AECOM 2011b, c). This may be due to higher levels of timber harvesting on non-federal than federal lands, specifically harvesting of coniferous species. Portions of several non-federal lands have been recently logged (Lake County Lands South and Wolf Lands 3, in particular).

5.1.7.2 Direct and Indirect Effects

Proposed Action

Species Conditions

Federal Lands

No Habitat Group 6 RFSS were found during plant surveys on the federal lands, despite the fact that upland forest habitat comprised almost 40% of the federal lands (**Table 6**). Thus, there should be no direct or indirect effects to Habitat Group 6 RFSS from the Project on federal lands.

Non-federal Lands

No Habitat Group 6 RFSS were found during plant surveys on the non-federal lands, despite the fact that upland forest habitat comprised about 39% of the habitat on non-federal lands (**Table 6**). Under the land exchange, the Forest Service would administer the non-federal lands. The Forest Service would monitor Habitat Group 6 RFSS use of these lands, and seek to protect high quality habitat for these species. Some species, such as barren strawberry and Canada ricegrass, seem to tolerate disturbance on opening-up of timber stands.

Habitat Conditions

Federal Lands

There are 2,582 acres of upland forest on the federal lands that can provide habitat for these RFSS (**Table 6**). Upland forest is more prevalent on the portion of the federal lands within the Mine Site, making up 62% (1,694 acres) of the habitat. About 30% of the upland forest on the federal lands is immature or mature forest. The Project would affect about 1,037 acres of upland forest habitat and affected areas would not provide habitat for Habitat Group 6 RFSS for at least 20 years after mining and reclamation, and much longer for Habitat Group 6 RFSS that favor more mature forest habitat.

Non-federal Lands

There are 2,774 acres of upland forest habitat that could be used by Habitat Group 6 RFSS on the non-federal lands (**Table 6**). There is less upland forest habitat (39%), on a percentage basis, on the non-federal lands than on the federal lands. Timber harvest, and road building and recreational activities, could alter or destroy habitat for these species if these lands are transferred to the Forest Service. Under the Proposed Action, the Forest Service would survey for Habitat Group 6 RFSS and associated habitat prior to conducting land-disturbing activities; areas of known or potential habitat would be avoided when feasible. Most recreational activity would be confined to existing trails and roads and would not likely affect Habitat Group 6 RFSS that favor upland forests.

Alternative B

Federal Lands

There should be no direct effects to New England sedge, fan lichen, Canada yew, Canada ricegrass, and barren strawberry on federal lands from the Project as these species have not been reported on the federal lands. Under Alternative B, there are 2,093 acres of upland forest on the federal lands (**Table 6**). About 489 fewer acres of upland forest habitat would be transferred to PolyMet from the Forest Service than would occur under the Proposed Action, but direct and indirect effects to Habitat Group 6 RFSS species and their habitats from the Project activities would remain the same.

Non-federal Lands

There would be no direct effects to New England sedge, fan lichen, Canada yew, Canada ricegrass, and barren strawberry under Alternative B. There are about 2,420 acres of suitable habitat (MIH 1 and 5) on Hay Lake Lands, which is about 87% of the upland forest found on the non-federal lands (**Table 6**). Prior to implementing ground-disturbing activities, the Forest Service would conduct RFSS surveys of Hay Lake Lands to determine if RFSS would be affected by proposed activities. These surveys should help to ensure that RFSS found on the lands are avoided, where feasible. Under Alternative B, however, about 354 acres of upland forest habitat that is found on the other non-federal lands would remain under private ownership (**Table 6**).

No Action Alternative

There would be no direct or indirect effects to Habitat Group 6 RFSS under the No Action Alternative.

5.1.7.3 Cumulative Effects

As discussed in Section 4.5.2, it is possible that Habitat Group 6 RFSS and/or their habitat have been lost from past and ongoing activities in the CESA, and would be lost in the future from similar reasonably foreseeable future activities.

Timber harvest and road construction have affected upland forests and reduced the amount and distribution of this habitat within the CESA. Construction and use of roads in upland forests under the Proposed Action, Alternative B, and No Action Alternative and elsewhere in the CESA would continue to affect suitable habitat. For Canada ricegrass and barren strawberry, however, timber harvest should not have any long-term cumulative effects to habitat for these species because they appear to be able to tolerate some levels of disturbance. Suitable habitat for fan lichen (in the form of tip-ups) would continue to be created by future timber harvests.

There should be no direct or indirect effects to individuals of Habitat Group 6 RFSS from mining. About 1,037 acres of upland forest on the federal lands would be lost to mining and would be an adverse cumulative effect (**Table 6**).

Timber harvesting, road building, and recreational activities could occur in the future on the federal and non-federal lands, depending upon the whether the Proposed Action, Alternative B, or the No Action Alternative is selected in the Record of Decision. In addition, there is the potential for homes and cabins to be built on the non-federal lands, should the FEIS Record of Decision select the No Action Alternative and non-federal lands remain under private ownership. These activities could harm Habitat Group 6 RFSS and their habitats. There are about 31,000 acres of upland deciduous hardwood forest, and about 161,000 acres of upland conifer forest, in the CESA (Emmons and Olivier, Inc. 2006:30, 38), and Habitat Group 6 RFSS are found throughout the Superior National Forest, including on the Tracks Project area. The Forest Service would survey for RFSS prior to conducting land-disturbing activities, and would avoid areas with known or potential habitat for RFSS when feasible on lands they administer.

5.1.7.4 Summary

Project activities associated with the Proposed Action and Alternative B should have no direct or indirect adverse effects on individual Habitat Group 6 RFSS or their habitats because these species have not been found on the Mine Site. The Project would result in the cumulative loss of about 1,037 acres of potential habitat for these species on the federal lands (**Table 6**). Other activities in the CESA would also contribute to cumulative effects toward the RFSS plants of this habitat group. The Proposed Action and Alternative B would have similar effects on Habitat Group 6 RFSS. There should be no effects to Habitat Group 6 RFSS or their habitats from the No Action Alternative.

5.1.7.5 Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for New England sedge, fan lichen, Canada yew, Canada ricegrass, and barren strawberry. The No Action Alternative would have **no impact** to individuals of Habitat Group 6 RFSS.

5.1.7.6 Mitigation and Recommendations

No mitigation measures are recommended for Habitat Group 6 RFSS.

5.2 Animals

5.2.1 Animals Not Evaluated in the Biological Evaluation

As shown in **Table 1**, there is no suitable habitat on the federal and non-federal lands for lake sturgeon, Nipigon cisco, and Shortjaw cisco. The Proposed Action, Alternative B, and No Action Alternative would have **no impact** to individuals of these species, and they will not be addressed further in this BE.

5.2.2 Mussels

Unionid mussels (*Unionidae*) constitute one of the most imperiled major taxa in the U.S. (Master et al. 2000), and 33 unionid species within Minnesota are state-endangered (13 species), threatened (11 species), or species of special concern (9 species). Two of these species, creek heelsplitter and black sandshell, both RFSS, are known to occur in the St. Louis River Watershed. No listed freshwater mussel species were observed on federal during mussel surveys for the Project (Heath 2004, 2011). No listed freshwater mussel species are known to occur on the non-federal lands.

5.2.2.1 Environmental Baseline

Creek Heelsplitter (*Lasmigona compresssa*)

The creek heelsplitter typically occurs in small headwater streams and requires riverine habitat conditions to survive and proliferate. It has also been documented at or near river inlets on lakes on the Superior National Forest. Although the creek heelsplitter is capable of self-fertilization, it relies extensively on host fish species for its parasite life stage (glochidia larvae) and dispersal. Because of its habitat and host fish requirements, the creek heelsplitter may be affected by vegetative management and road construction activities that could potentially increase sedimentation and streamflow, as well as create potential host fish migration barriers at road crossings.

The creek heelsplitter has not been reported on the federal or non-federals lands. It is not known to occur on the Partridge River in the vicinity of the Project area. On Hunting Club Lands, the creek heelsplitter is unlikely to be found as the creek that flows through the lands because the creek does not have a sandy substrate. There are no streams or rivers associated with Wolf Lands 1 and 2, Lake County Lands, or McFarland Lake Lands (AECOM 2011a, b).

There is potential habitat for the species on Hay Lake Lands and Wolf Lands 3 and 4. It has not been reported on Hay Lake Lands, but suitable habitat may exist in the Pike River. This species has been documented 2.3 miles downstream of the Hay Lake Lands at the Sand and Pike Rivers confluence, where the Pike River becomes a fourth-order stream. On the Hay Lake Lands, third-order segments of the Pike River may offer adequate sand substrate and flow to provide habitat for this species.

While the creek heelsplitter is not known to occur within or in the immediate vicinity of Wolf Lands 3 or 4, it has been documented near the eastern and western confluence of the northernmost lake in the chain of McDougal Lakes and in the third-order stretch of the Stony River. Therefore, it could occur in Coyote Creek, which flows from Wolf Lands 3 and 4 into McDougal Lakes, and is near the Stony River. The habitat in Coyote Creek within Wolf Lands 3 and 4 is unknown, but it could display first-order headwater stream characteristics.

The creek heelsplitter is known to occur on the Track Project area in the Cloquet River, and may occur in larger tributaries of the Cloquet River.

Black Sandshell Mussel (*Ligumia recta*)

The black sandshell mussel is primarily a riverine species that requires deep run or glide habitat in wide rivers with moderate current.

The black sandshell mussel is known to occur on the Superior National Forest, although near the edge of this species range. It has been documented in several locations in the St. Louis River system. The black sandshell mussel is not known to occur on the federal or non-federal lands, or within the Tracks Project area. The nearest documented occurrences of this species to the Project area are four locations in the St. Louis River, approximately 9 to 11 miles south to southwest of the federal lands. There is suitable habitat in the Pike River (Hay Lake Lands) and possibly Coyote Creek (Wolf Lands 3 and 4) for the black sandshell mussel. The Langley or Cloquet Rivers (Tracks Project area) may also support individuals or populations and provide habitat for the black sandshell mussel.

5.2.2.2 Direct and Indirect Effects

Proposed Action

There should be no direct effects to creek heelsplitter and black sandshell mussels from the Project as they have not been reported on the federal lands. Because the Project should not result in any measurable changes in habitat quality and flow regimes in the Partridge River, and no change in water quality (for any of the Class B water quality standards), no effects to the habitat for these species are expected within the Partridge River Watershed. Section 5.2.6 of the FEIS provides additional information on anticipated changes to flow regimes.

No creek heelsplitter or black sandshell mussels have been reported on the non-federal lands, although the creek heelsplitter has been documented in the Pike River, about 2.3 miles downstream of Hay Lake Lands, and in the Stony River near Wolf Lands 3 and 4. Under the Proposed Action, the Forest Service would survey for creek heelsplitter and black sandshell mussels and associated habitat prior to conducting land-disturbing activities; areas of known or potential habitat would be avoided when feasible.

Alternative B

Potential effects to creek heelsplitter and black sandshell mussel from Project activities would be similar to those under the Proposed Action. Under Alternative B, PolyMet would administer lands on which the Partridge River flows.

The Forest Service would acquire Hay Lake Lands under Alternative B. The Pike River flows along the eastern boundary of these lands. As noted above, suitable habitat for the creek heelsplitter could be found in the third-order segments of the Pike River, and this species has been found about 2.3 miles downstream of Hay Lake Lands. Creek heelsplitter habitat may occur on Coyote Creek within Wolf Lands 3 and 4 that would remain privately owned.

No Action Alternative

There would be no direct or indirect effects to creek heelsplitter or black sandshell mussel under the No Action Alternative.

5.2.2.3 Cumulative Effects

Substrate quality, channel stability, and host fish migration opportunities are key habitat components for maintaining individuals, populations, and habitat of creek heelsplitter and black sandshell mussel. It is likely that timber harvest, road and trail construction, and poorly designed stream crossings may have affected RFSS mussels and their habitat by altering stream channels and flow, contributing sediment into local streams, increasing stream temperatures, and restricting host fish migration within the CESA (USDA Forest Service 2004a).

Undeveloped federal and non-federal lands could be managed for timber production, and the developed portions of the Mine Site could be managed for timber after reclamation. Use of unclassified roads on federal and non-federal lands may contribute sediment into local streams and potentially threaten RFSS mussels and their habitat, although this input should be minimal if existing roads are used or reclaimed and no new roads are constructed near streams. Road construction and timber management activities could affect individuals, populations, and/or habitat of creek heelsplitter and black sandshell mussel on the Partridge River, Pike River, and Coyote Creek. These activities could potentially increase the inputs of fine sediment into local streams, increase or reroute stream flows, increase stream temperatures, and disrupt existing and/or future habitat unless properly mitigated. These effects could be mitigated by following design criteria to minimize effects to riparian zone habitat, including prohibiting the harvest of trees would occur within certain distances of different types of streams except for the purpose of maintaining or restoring riparian ecological function.

Standards and guidelines in the Forest Plan and best management practices would help to ensure that land management activities would not contribute to cumulative effects (USDA Forest Service 2004a). Provided that best management practices are implemented by landowners and managers, there should be no long-term cumulative effects to creek heelsplitter and black sandshell mussels and habitat from reasonably foreseeable future activities.

There should be no cumulative effects to creek heelsplitter and black sandshell mussel or their habitats from the Project as they have not been reported on or near the federal lands and the Project is not predicted to result in any measurable changes in water flows or water quality within the Partridge River Watershed. Creek heelsplitter has been found near Hay Lake Lands, and would be afforded protection by the Forest Service under both the Proposed Action and Alternative B.

5.2.2.4 Summary

The Proposed Action, Alternative B, and No Action Alternative should have no direct, indirect, or cumulative effects to individuals or habitat of creek heelsplitter or black sandshell mussel.

5.2.2.5 Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** creek heelsplitter or black sandshell mussels. The No Action Alternative would have **no impact** to creek heelsplitter or black sandshell mussel individuals.

5.2.2.6 Mitigation and Recommendations

No mitigation measures are recommended for creek heelsplitter or black sandshell mussel.

5.2.3 Insects

Although no RFFS insects have been reported on the federal or non-federal lands, there are six RFFS insects that could have suitable habitat on the federal and/or non-federal lands—headwaters chilostigman caddisfly, ebony boghaunter, Quebec emerald dragonfly, taiga alpine, Nabokov's blue butterfly, and Freija's grizzled skipper.

5.2.3.1 Headwaters Chilostigman Caddisfly (*Chilostigma itasca*), Ebony Boghaunter (*Williamsonia fletcheri*), and Quebec Emerald Dragonfly (*Somatochlora brevicincta*)

Environmental Baseline

Headwaters Chilostigman Caddisfly (*Chilostigma itasca*)

Little is known about the headwaters chilostigman caddisfly. It has only been discovered in two locations within Minnesota. In 1994, it was documented in a slow-moving, silt-dominated headwater stream in Itasca State Park and in 2005, in a rich swamp to poor fen habitat at Finland State Forest, which is about 4 miles north of Lake County Lands South.

Observations at Finland State Forest were within a large, acid to minerotrophic peatland complex. These peatlands have a loose to moderately dense canopy of black spruce and tamarack, with some northern white cedar, and a shrub layer of speckled alder and bog birch. Sphagnum mosses, sedges, and several heath species dominate the ground layer. Shallow pools among the hummocks and narrow streamlets are a characteristic feature where adults were observed crawling around on the snow. Adults were also observed in an aspen-mixed coniferous forest on a ridge adjacent to this peatland complex. Presumably these adults wandered from the peatland where larval development took place.

Habitats similar to those at Finland State Forest occur within the One Hundred Mile Swamp on the federal lands. However, because the distribution of this caddisfly appears to be very limited, it is unlikely that this species occurs on the federal or non-federal lands.

Headwaters chilostigman caddisfly has not been reported on the federal or non-federal lands, or the Tracks Project area.

Ebony Boghaunter (*Williamsonia fletcheri*)

The ebony boghaunter uses low elevation sphagnum bogs adjacent to coniferous or mixed coniferous/deciduous forest. It is usually absent from bogs that lack sphagnum. Larvae may develop in shallow pools (6 to 12 inches) in sedge fens or among sphagnum mats that have open pools and are not choked with

heaths. The adult male territorial arenas and adult perching sites are often in small, sun-lit clearings in the forest surrounding the laying habitat, not in completely open upland habitat. The ebony boghaunter has not been identified from benthic macroinvertebrate surveys conducted on and near the federal lands, and it has not been reported on the non-federal lands or Tracks Project area. Habitat likely exists for the ebony boghaunter on the federal and non-federal lands in bogs.

Quebec Emerald Dragonfly (*Somatochlora brevicincta*),

The Quebec emerald dragonfly occurs in lentic habitats typically associated with bogs, fens, and heaths near water-saturated or water-suspended sphagnum moss. The microhabitat is water-suspended or water-saturated sphagnum moss, whether or not associated with open water, and typically having grass-like emergent plants indicating weak minerotrophism. Eggs are laid outside plant tissues on the moss or adjacent water surface, with the larvae likely living within the saturated moss rather than on the water interface. The species has not been observed on open-water peatland ponds. Landforms in which the habitat can develop will generally consist of bedrock or surficial deposits with little mineralizing potential. Habitat may also form adjacent to or within peat bogs or heaths in low relief areas.

The Minnesota Odonata Survey Project found an individual in northern Lake County approximately 30 miles northeast of the Project area in 2006. This RFSS' habitat requirements are not well-understood in Minnesota. Suitable habitat could be present within the federal lands near the bogs associated with the headwater stream, Yelp Creek. It could inhabit poor fens and wet meadow/sedge meadow habitat found on the federal and non-federal lands. However, the likelihood of observing Quebec emerald dragonfly individuals or populations in the vicinity of the federal or non-federal lands is low.

Quebec emerald dragonfly was not found during benthic macroinvertebrate surveys of the federal lands (Breneman 2005, Barr 2011), and has not been reported on the non-federal lands, or the Tracks Project area.

Direct and Indirect Effects

Proposed Action

There should be no direct or indirect effects to headwaters chilostigman caddisfly, ebony boghaunter, or Quebec emerald dragonfly as they have not been reported on the federal lands and sightings have been 30 miles or more from the federal lands. These species favor slow-moving streams, bogs, and fens, which are similar to sedge/wet meadow habitat. There are 2,207 acres of habitat that could be used by these RFSS insects on the federal lands (210 acres of open bog, 1,961 acres of coniferous bog, and 36 acres of sedge/wet meadow; **Table 8**). A total of 547 acres of these habitats (512 acres of open and coniferous bog and 35 acres of sedge/wet meadow) would be disrupted by mining activities.

Because the Proposed Action should not result in any measurable changes in flows or water quality (for any of the Class B water quality standards) in the Partridge River, negligible effects to the headwaters chilostigman caddisfly, ebony boghaunter, or Quebec emerald dragonfly are expected within the Partridge River Watershed from the Project.

The headwaters chilostigman caddisfly, ebony boghaunter, and Quebec emerald dragonfly have not been reported on the non-federal lands, although the headwaters chilostigman caddisfly has been found at Finland State Forest, which is about 4 miles north of Lake County Lands South. There are 7 acres of open bog habitat

that could be used by these RFSS insects on the non-federal lands (**Table 8**). Under the Proposed Action, the Forest Service would survey for chilostigman caddisfly, ebony boghaunter, and Quebec emerald dragonfly and associated habitat prior to conducting land-disturbing activities; areas of known or potential habitat would be avoided when feasible.

Alternative B

Potential effects to headwaters chilostigman caddisfly, ebony boghaunter, or Quebec emerald dragonfly from Project activities would be the same as under the Proposed Action. Under Alternative B, there would be 1,887 acres of habitat that could be used by these RFSS insects on the federal lands (175 acres of open bog, 1,677 acres of coniferous bog, and 35 acres of sedge/wet meadow; **Table 8**). About 320 fewer acres of habitat would be transferred to PolyMet from the Forest Service than under the Proposed Action. Habitat loss to mining activities would be the same under Alternative B as under the Proposed Action.

Under Alternative B, the Forest Service would acquire Hay Lake Lands. No headwaters chilostigman caddisfly, ebony boghaunter, or Quebec emerald dragonfly have been reported on or near Hay Lake Lands. Based on a habitat assessment, there are only 2 acres of open bog habitat on Hay Lake Lands that could provide habitat for these species. About 30% of the available habitat that occurs on the non-federal lands is found on Hay Lake Lands (AECOM 2011b).

No Action Alternative

There would be no direct or indirect effects to headwaters chilostigman caddisfly, ebony boghaunter, or Quebec emerald dragonfly under the No Action Alternative.

Cumulative Effects

Past, present, and reasonably foreseeable future actions from land management and development include federal, state, county, and private road construction and timber management projects, private development, and routine road maintenance and transportation activities. The CESA has mixed ownership with roads crossing from one landowner to the next, and includes multiple jurisdictions. Standards and guidelines in the 2004 Forest Plan help to ensure that Forest Service activities do not contribute to cumulative effects (USDA Forest Service 2004a). In addition to federal standards and guidelines, state, private and local land owners and managers follow established best management practices that should help to minimize cumulative effects.

There should be no cumulative effects to headwaters chilostigman caddisfly, ebony boghaunter, or Quebec emerald dragonfly from the Project as they have not been reported on or near the federal lands. About 547 acres of habitat that could be used by these species on the federal lands would be directly affected by the Project, but given that there are about 368,000 acres of bog, sedge/wet meadow, and lowland conifer habitat within the CESA, habitat loss from the Project would have a negligible cumulative effect (Emmons and Olivier Resources, Inc. 2006:30, 38).

Summary

Project activities associated with the Proposed Action and Alternative B should have no adverse direct or indirect effects on individual headwaters chilostigman caddisfly, ebony boghaunter, or Quebec emerald dragonfly or their habitats, but the Project could cause cumulative effects to these species through loss of

potential habitat for these species on the federal lands. Other activities in the CESA would also contribute to cumulative effects toward this species. There would be no effects to headwaters chilostigman caddisfly, ebony boghaunter, or Quebec emerald dragonfly or their habitats from the No Action Alternative.

Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for headwaters chilostigman caddisfly, ebony boghaunter, or Quebec emerald dragonfly. The No Action Alternative would have **no impact** on individuals of these species.

Mitigation and Recommendations

No mitigation measures are recommended for headwaters chilostigman caddisfly, ebony boghaunter, or Quebec emerald.

5.2.3.2 Taiga Alpine (*Erebia disa mancinus*)

Environmental Baseline

The taiga alpine occurs across northern North America. The taiga alpine's only occurrence in the contiguous U.S. is in Minnesota, where it is known from only a handful of localities in a small area in the northeast part of the state. These locations include the Sand Lake Peatland Scientific and Natural Area, which is about 8 miles north of Lake County Lands North and Wolf Lands 1, 5 miles west of Wolf Lands 2, and 8 miles west of Wolf Lands 3; and the McNair Management Area near Lake County Lands South. Recent surveys in the Glacial Lake Agassiz peatlands have not discovered any occurrences there, suggesting that taiga alpine has highly specialized habitat requirements. Because of the small number of known locations, the taiga alpine is likely vulnerable to habitat destruction and catastrophic events.

In Minnesota, the taiga alpine appears to favor black spruce bogs and swamps where immature black spruce trees form a park-like environment, with small bushy trees dotting the understory. This type of habitat is abundant in northern Minnesota, making the very restricted distribution of the butterfly an enigma. In Canada, where it is more common and widespread, it occurs in a broader range of habitats, most commonly in open black spruce-sphagnum bogs.

The taiga alpine was not searched for during field surveys for the Project and the MDNR NHIS database has no records of taiga alpine occurring on or in the vicinity of the federal or non-federal lands. Taiga alpine was found during surveys of the Tracks Project area.

Direct and Indirect Effects

Proposed Action

Taiga alpine has not been observed on or near the federal lands. There are 3,060 acres of lowland coniferous forest (MIH 9) within the federal lands that could provide habitat for this butterfly (**Table 6**). The Project would affect about 482 acres of lowland coniferous forest.

Taiga alpine has not been reported on the non-federal lands, although it has been found within 8 miles of Lake County Lands North, and Wolf Lands 2 and 3. There are about 3,309 acres of lowland coniferous forest habitat

on the non-federal lands that could provide habitat for taiga alpine (**Table 6**). Under the Proposed Action, the Forest Service would survey for taiga alpine and associated habitat prior to conducting land-disturbing activities; areas of known or potential habitat would be avoided when feasible.

Alternative B

Potential direct and indirect effects to taiga alpine and its habitat from Project activities would be similar to those under the Proposed Action. Under Alternative B, there would be about 2,079 acres of lowland coniferous forest on the federal lands that would be transferred to PolyMet (**Table 6**), or about 982 fewer acres of lowland coniferous forest that be transferred to PolyMet from the Forest Service than under the Proposed Action. In particular, portions of One Hundred Mile Swamp would remain under Forest Service management. Habitat loss due to mining activities would be the same under Alternative B as under the Proposed Action.

Under Alternative B, the Forest Service would acquire Hay Lake Lands. There are about 1,818 acres of lowland coniferous forest on Hay Lake Lands (**Table 6**). About 55% of lowland coniferous forest that occurs on the non-federal lands is found on Hay Lake Lands.

No Action Alternative

There would be no direct or indirect effects to taiga alpine under the No Action Alternative.

Cumulative Effects

As discussed in Section 4.5.2, mature black spruce and tamarack lowland forest has been lost from past and ongoing activities in the CESA, and would be lost in the future from similar reasonably foreseeable future activities.

Because European settlement, timber harvest, mining, wetland drainage, and road construction have affected forested wetlands and reduced the amount and distribution of this habitat within the CESA. More recently, timber sales on federal, state, county, and private lands have changed the age class distribution of lowland black spruce habitats, but have not altered the overall suitability of the habitat for taiga alpine.

Construction and use of roads in lowland forests under the Proposed Action, Alternative B, and No Action Alternative, and elsewhere in the CESA would continue to affect suitable habitat. Timber sales affecting lowland forests on state or county lands could change the age class of lowland black spruce forests in the Project area, temporarily making some stands less suitable for taiga alpine. However, the proportion of total suitable habitat affected by these activities would be very small in relation to habitat availability within the CESA.

The Project should not directly affect taiga alpine. About 482 acres of lowland coniferous forest habitat that could be used by this species on the federal lands would be directly affected by the Project (**Table 6**). Despite the potential cumulative effects of the Project, taiga alpine habitat is common in the CESA and about 356,000 acres of lowland coniferous forest/shrubland would remain in the CESA after the Project (Emmons and Olivier Resources, Inc. 2006:30, 38).

PolyMet would acquire lowland coniferous forest on the federal lands surrounding the Mine Site under the proposed land exchange. Although these lands would remain privately owned, it is likely that some or all of these lands would be managed for timber production and harvested in the reasonably foreseeable future. Timber

harvest and associated road construction could directly or indirectly affect taiga alpine habitat. Effects from timber management would be mitigated by voluntary adherence to best management practices (Minnesota Forest Resources Council 1999).

Under the Proposed Action and Alternative B, all or portions of the non-federal lands would be transferred to the Forest Service, who would manage the lands for timber production, recreation, nature study, and other values. Taiga alpine has not been reported on the non-federal lands, but has been observed within 8 miles of several non-federal lands, and there are about 3,309 acres of lowland coniferous forest on the non-federal lands.

Forest management activities could result in ground disturbance that adversely affects taiga alpine habitat, and possibly even individual butterflies. However, timber harvest activities would be conducted during winter in lowland coniferous forest to reduce the risks of ground disturbance and sedimentation. Should disturbance activities occur on the non-federal lands, it could take 80 or more years before disturbed lands would be suitable for taiga alpine. Prior to implementing ground-disturbing activities, the Forest Service would conduct RFSS surveys to determine if RFSS would be affected by proposed activities. These surveys should help to ensure that RFSS species found on non-federal lands are avoided, where feasible.

Summary

Project activities associated with the Proposed Action and Alternative B should have no adverse direct or indirect effects on individual taiga alpine or their habitat, but the Project could cause cumulative effects to potential habitat for taiga alpine on the federal lands. Other activities in the CESA would also contribute to cumulative effects toward this species. The Proposed Action and Alternative B would have similar effects on taiga alpine, while there would be no effects to this species from the No Action Alternative.

Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for taiga alpine. The No Action Alternative would have **no impact** on individuals of this species.

Mitigation and Recommendations

No mitigation measures are recommended for taiga alpine.

5.2.3.3 Nabokov's Blue (*Lycaeides idas nabokovi*) and Freija's Grizzled Skipper (*Pyrgus centaureae freija*)

Environmental Baseline

Nabokov's Blue (*Plebejus idas nabokovi*)

Populations of Nabokov's blue tend to occur in geographic clusters, or metapopulations, linked by distances of 1 to 2 miles. Fewer than five metapopulations are known to occur in each of the Great Lake States (Michigan, Minnesota, and Wisconsin); several of the most important sites occur on U.S. Forest Service lands (Wolf 2002 and references cited therein). Recent Minnesota records for Nabokov's blue are confined to the three northeastern most counties (St. Louis, Lake, and Cook), including the McNair Butterfly Management Area, which is approximately 23 miles southeast of the federal lands and 9 to 13 miles from Wolf Lands 1 and 2,

respectively (BAMONA 2013). Focused searches in the past few years have discovered several new occurrences of Nabokov's blue, although most appear to be small colonies.

In Minnesota, all known colonies of this butterfly occur at sandy sites, including those with jack pine, but it is recorded on rock outcrops in Michigan. Because the species' preferred habitat is open woodland where the larval host plant, dwarf bilberry, is abundant, forest fires were probably important in creating and maintaining habitat for the species.

Active forest management can play a major role in conservation of these rare species. Encroachment of dense vegetation and woody plants is a major threat to existing populations, especially in the southern part of their geographic range. Fire suppression has likely been responsible for loss of habitat for dwarf bilberry during the past 50 years or longer (Wolf 2002).

Freija's Grizzled Skipper (*Pyrgus centaureae freija*)

The Freija's grizzled skipper has only been observed at a single locality in Minnesota, on the McNair Butterfly Management Area. It could occur at other locations in Minnesota, and the absence of additional records may be explained by its spring flight period, when weather is often unsuitable for butterfly activity, and by the poor understanding of its habitat preferences. At the one known location on the McNair Butterfly Management Area, Freija's grizzled skipper occurs in a large, old clearing on sandy soils dominated by grasses, with some willow, speckled alder, dwarf bilberry, and blueberries. Black spruce and tamarack swamps border the clearing in places.

Direct and Indirect Effects

Proposed Action

No butterfly surveys were conducted on the federal and non-federal lands. Based on observations of Nabokov's blue and Freija's grizzled skipper in Minnesota, however, it is unlikely that they are found on or near the federal lands, and thus there should be no direct or indirect adverse effects to these species from the Proposed Action. These butterflies favor sandy and rocky sites associated with jack pine and other upland coniferous forest, which are rare on the federal lands.

There are 1,252 acres of upland coniferous forest habitat (MIH 5) on the federal lands that could provide habitat for Nabokov's blue and Freija's grizzled skipper (**Table 6**). The Project would affect about 505 acres of upland coniferous forest habitat.

Nabokov's blue and Freija's grizzled skipper have not been reported on the non-federal lands, although they have been found within 23 miles of the federal lands and 9 miles of the non-federal lands. There are about 80 acres of upland coniferous forest on the non-federal lands that could provide habitat for Nabokov's blue and Freija's grizzled skipper (**Table 6**). These lands would not be affected by the Project. Under the Proposed Action, the Forest Service would survey for Nabokov's blue and Freija's grizzled skipper and associated habitat prior to conducting land-disturbing activities; areas of known or potential habitat would be avoided when feasible.

Alternative B

Potential direct and indirect effects to Nabokov's blue and Freija's grizzled skipper and their habitat from Project activities would be similar to those under the Proposed Action. Direct effects to upland coniferous forests from the Project would be similar for both the Proposed Action and Alternative B. Under Alternative B, there are 1,139 acres of upland coniferous forest habitat on the federal lands (**Table 6**). About 114 fewer acres of upland coniferous forest would be transferred to PolyMet from the Forest Service than under the Proposed Action. Habitat loss to mining activities would be the same under Alternative B as under the Proposed Action.

Under Alternative B, the Forest Service would acquire Hay Lake Lands. There are 55 acres of upland coniferous forest habitat on Hay Lake Lands (**Table 6**). About 68% of the upland coniferous forest on the non-federal lands is found on Hay Lake Lands.

No Action Alternative

There would be no direct or indirect effects to Nabokov's blue and Freija's grizzled skipper under the No Action Alternative.

Cumulative Effects

As discussed in Section 4.5.2, upland coniferous forest has been lost from past and ongoing activities in the CESA, and would be lost in the future from reasonably foreseeable future activities. Timber management activities have led to the creation of young upland forest habitat in areas that are suitable habitat for Nabokov's blue and Freija's grizzled skipper over much of the Arrowhead region, especially on private lands that tend to have shorter harvest rotations than federal lands. On the Superior National Forest, projections show decreasing young forest habitat (upland forest younger than 9 years) and greatly increasing immature and mature (upland conifer older than 10 years) forest habitat (USDA Forest Service 2010b). Timber harvest and associated road construction could help to promote habitat for Nabokov's blue and Freija's grizzled skipper.

The Project should not directly affect individual Nabokov's blue and Freija's grizzled skipper or their habitat, but could cumulatively affect these species through loss of potential habitat. About 505 acres of upland coniferous forest habitat that could be used by these species on the federal lands would be directly affected by the Project. Although there are few populations of Nabokov's blue and Freija's grizzled skipper in Minnesota, they are more common outside of Minnesota. There are also about 161,000 acres of upland coniferous forest within the CESA that could provide habitat for Nabokov's blue and Freija's grizzled skipper (Emmons and Olivier Resources, Inc. 2006:30, 38).

Under the Proposed Action and Alternative B, all or portions of the non-federal lands would be transferred to the Forest Service, who would manage the lands for timber production, recreation, and other activities. Forest management activities could result in ground disturbances that adversely affect Nabokov's blue and Freija's grizzled skipper and their habitat. The Forest Service would survey for Nabokov's blue and Freija's grizzled skipper prior to conducting land-disturbing activities, and would avoid areas with known or potential habitat for Nabokov's blue and Freija's grizzled skipper when feasible. Should disturbance activities occur on the non-federal lands, it would take 10 or more years before disturbed lands would be suitable for Nabokov's blue and Freija's grizzled skipper. The Forest Service would conduct RFSS surveys to determine if Nabokov's blue and Freija's grizzled skipper would be affected by any proposed land-disturbance activities. These surveys should help to ensure that these RFSS, if found on Hay Lake Lands, are avoided, where feasible.

Summary

Project activities associated with the Proposed Action and Alternative B should have no adverse direct or indirect effects on Nabokov's blue and Freija's grizzled skipper, but the Project could cause cumulative adverse effects to these species through loss of potential habitat. Other activities in the CESA would also contribute to cumulative effects toward these species. The Proposed Action and Alternative B would have similar effects on Nabokov's blue and Freija's grizzled skipper, while there would be no effects to these species from the No Action Alternative.

Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for Nabokov's blue and Freija's grizzled skipper. The No Action Alternative would have **no impact** to individuals of these species.

Mitigation and Recommendations

No mitigation measures are recommended for Nabokov's blue and Freija's grizzled skipper.

5.2.4 Fish

The only RFSS fish for which there is habitat near the Project area is northern brook lamprey, although they have not been reported on or near the federal lands or non-federal lands. There could be potential habitat for northern brook lamprey within the Partridge River, and within several streams on the non-federal lands.

5.2.4.1 Northern Brook Lamprey (*Ichthyomyzon fossor*)

Environmental Baseline

The northern brook lamprey is a non-parasitic lamprey that is uncommon and has relatively restricted range in Minnesota. They require moderately warm, low-gradient streams with sections of higher gradient (riffle) reaches suitable for spawning. They are most common in streams of medium size, averaging 60-feet wide and 3-feet deep; but can occur in smaller (3- to 10-feet wide) and larger rivers (100- to 325-feet wide). Spawning occurs in May to June in gravel areas near riffles with water depths of about 1 foot. Larval forms (ammocoetes) require soft substrate (approximately 80% sand and silt) for burrowing, often among vegetation at depths of 6 to 20 inches. The diet of ammocoetes consists of diatoms and unicellular algae. Growth is rapid and larvae require organically enriched, sandy substrate until metamorphosis. After a 3- to 6-year growth period, metamorphosis occurs and adults spawn about 3 to 4 months afterwards. As adults, they do not feed and are believed to die a few days after spawning. Northern brook lamprey occurs in medium-size streams in several watersheds on the Superior National Forest.

There are no known occurrences of this species on or near the federal lands. Northern brook lampreys were found at a site south of Cloquet, Minnesota, approximately 75 miles south of the Project area. Since 1986, it has been collected from six other sites in the Lake Superior drainage. Potential habitat near the Project area includes sections of the St. Louis, Cloquet, and Partridge Rivers.

Northern brook lamprey has not been reported on or near non-federal lands, although suitable habitat for the species likely occurs on Hay Lake Lands and Wolf Lands. This species has not been documented on the Tracks Project area.

Direct and Indirect Effects

Proposed Action

There would be no direct or indirect effects to northern brook lamprey from the Project as this species has not been observed on or near the Project area, although suitable habitat for the species could occur in the Partridge River. Because the Project should not contribute sediment, increase stream temperatures, or substantially alter stream flow in the Partridge River, no effects to habitat for this species are expected.

Northern brook lampreys have not been reported on or near non-federal lands, although suitable habitat for the species could occur in the Pike River on Hay Lake Lands and in Coyote Creek on Wolf Lands 4. Under the Proposed Action, the Forest Service would survey for northern brook lamprey and associated habitat prior to conducting land-disturbing activities; areas of known or potential habitat would be avoided when feasible.

Alternative B

There would be no direct or indirect effects to northern brook lamprey from the Project under Alternative B. Under Alternative B, the Forest Service would acquire Hay Lake Lands. The Pike River flows along the eastern boundary of the lands and could provide habitat for northern brook lamprey.

No Action Alternative

There would be no direct or indirect effects to northern brook lamprey under the No Action Alternative.

Cumulative Effects

Historical events, including overfishing, construction of dams, and resource management activities have affected individuals and populations of northern brook lamprey within the CESA. It is possible that historic timber harvest, road and trail construction, and poorly designed stream crossings may have affected northern brook lamprey habitat and ammocoete survival by contributing sediment, increasing stream temperatures, and altering stream flow (USDA Forest Service 2004b).

Use of unclassified roads on federal and non-federal lands may contribute sediment into local streams and potentially threaten RFSS fish and their habitat, although this input should be minimal if existing roads are used and no new roads are constructed near streams. Standards and guidelines in the Forest Plan would help to ensure that Forest Service activities would not contribute to cumulative effects (USDA Forest Service 2004a). In addition to federal standards and guidelines, state, private, and local land owners and managers follow established best management practices that should also contribute to reducing cumulative effects.

There should be no cumulative effects to northern brook lamprey and their habitat from the Project as northern brook lamprey have not been reported on or near the federal lands. The small decrease in the Partridge River flow that is predicted to occur during the Project is not likely to adversely affect the northern brook lamprey.

Under the Proposed Action and Alternative B, most Project roads would be reclaimed after mining. There could be timber management and road construction on the undeveloped portions of the federal and non-federal lands. Because Hay Lake Lands and Wolf Lands 4 could have northern brook lamprey habitat, there could be cumulative effects to potential habitat for northern brook lamprey.

Summary

Project activities associated with the Proposed Action and Alternative B should have no adverse direct, indirect, or cumulative effects on northern brook lamprey or their habitat. The Proposed Action and Alternative B would have similar effects on this species. Under the Proposed Action and Alternative B, the Partridge River (federal lands) and Pike River (non-federal lands) would be exchanged, but Coyote Creek, another stream that could have northern brook lamprey habitat, would not be exchanged under Alternative B. There would be no effects to northern brook lamprey or their habitats from the No Action Alternative.

Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for northern brook lamprey. The No Action Alternative would have **no impact** to individuals of northern brook lamprey.

5.2.4.2 Mitigation and Recommendations

No mitigation measures are recommended for northern brook lamprey.

5.2.5 Reptiles

One RFSS reptile, the wood turtle, has been observed near the federal lands and there could be potential habitat for wood turtles along the Partridge River within the federal lands, and along several streams on the non-federal lands.

5.2.5.1 Wood Turtle (*Glyptemys insculpta*)

Environmental Baseline

The wood turtle's range extends from Virginia to Nova Scotia and westward to Minnesota and northeast Iowa. The Project area is at the western edge of its range in Minnesota. The wood turtle is largely aquatic, preferring small- to medium-sized, fast-moving rivers and streams with adjacent deciduous and coniferous forests. The substrates of wood turtle streams typically consist of sand or gravel. Wood turtles will occupy adjacent alder thickets, forest, and grassland habitat for basking and foraging, typically staying within ¼ mile of the river or stream. Sandy, sparsely vegetated areas that are not prone to flooding and have ample exposure to direct sunlight provide important nesting sites.

The wood turtle occurs just south and west of the Superior National Forest along the St. Louis River and in the south end of the Superior National Forest along the Cloquet River; wood turtles were also found on the Tracks Project area. In the Cloquet River, all known populations use artificial sites such as gravel pits, road shoulders, and a turtle nesting island created in the late 1990s. Populations are isolated and the wood turtles may travel 3 miles along a stream to find nesting sites.

The MDNR NHIS database records indicate the northernmost population of wood turtles in the state occurs immediately south of the federal lands on the Partridge River. However, wood turtles are unlikely to be found on the federal lands because that the portion of the Partridge River within the federal lands does not have the sandy-gravelly morphology and sand bars that wood turtles prefer for hibernating, mating, and nesting.

The MDNR NHIS database did not identify sightings of wood turtles on or within a mile of the non-federal lands. There may be suitable habitat along the Pike River on Hay Lake Lands.

Direct and Indirect Effects

Proposed Action

There would be no direct effects to wood turtles from the Project as this species has not been observed on the federal lands. The small decrease in the Partridge River flow that is predicted to occur during the Project is not likely to affect the river morphology and should not adversely indirectly affect wood turtle habitat.

Should wood turtles occur in the vicinity of the Project area, the potential for indirect effects from contaminants, such as mercury, in ponds or discharge water, is not likely. Because the wood turtle inhabits woodland streams and adjacent habitat (alder thickets, forest, and grassland habitat) within about one-quarter mile of a stream, it is not likely to be found within the large open areas of the Plant Site or Mine Site during operations or near mining-related features such as stormwater and process water ponds associated with the Project. For example, the Tailings Basin Pond and Hydrometallurgical Residue Facility Pond would not have outlets and would be more than a quarter mile from a woodland stream. Similarly, process water ponds at the Mine Site (e.g., Overburden and Storage Laydown Area Pond) would not have outlets and would be more than one-quarter mile from a woodland stream.

The Plant Site and immediately adjacent lands provide no habitat or poor quality habitat for a wood turtle (e.g., lack of forest canopy over streams; slower flow in streams with numerous beaver ponds). During operations, water released from the Plant Site would include stormwater and treated waste water. Stormwater is expected to meet water quality standards after sedimentation ponds remove total suspended solids prior to being released off-site. Water discharged from the Waste Water Treatment Plant would be directed to Unnamed Creek (PM11), Trimble Creek, and Second Creek (at SD026) and would be required to meet water quality standards, including the mercury water quality standard of 1.3 ng/L. During reclamation, some ponds may be converted to wetlands that would receive precipitation and runoff water and this water would meet water quality standards. Other ponds, including the Hydrometallurgical Residue Facility Pond, would be filled and converted to terrestrial vegetation during reclamation and would have no potential to affect the wood turtle.

There could be potential wood turtle habitat along the Partridge River. During operations (Mine Years 1 through 20), there would be no permitted discharges of water from the Mine Site as process water and water accumulating in the mine pits would be pumped to the Plant Site. Stormwater released from the Mine Site is expected to meet water quality standards after sedimentation ponds remove total suspended solids prior to being released off-site. During reclamation, some ponds may be converted to wetlands that would receive precipitation and runoff water and would meet water quality standards. Other ponds, including the Overburden Storage and Laydown Area Pond, would be filled and converted to terrestrial vegetation during reclamation and would have no effect on the wood turtle. In long-term closure the West Pit Lake discharge would be treated at the Waste Water Treatment Facility (or by non-mechanical treatment after it is proven to meet water quality objectives), then discharged to the Upper Partridge River. This discharge channel would provide a riparian habitat that could

ANALYSIS AND DETERMINATION OF EFFECTS

be occupied by a wood turtle. Treated water discharged from the West Pit lake would comply with water quality standards, including mercury.

Overall, the potential for indirect effects to a wood turtle inhabiting a woodland stream near the Plant Site or Mine Site would be low and no adverse effects would be expected to occur to a wood turtle inhabiting a stream reach that receives stormwater or treated waste water.

Wood turtles have not been reported on or near the non-federal lands, although suitable habitat for the species could occur in the Pike River on Hay Lake Lands or in Coyote Creek on Wolf Lands 4. Under the Proposed Action, the Forest Service would survey for wood turtles and associated habitat prior to conducting land-disturbing activities and areas of known or potential habitat would be avoided when feasible.

Alternative B

Potential direct and indirect effects to wood turtles from the Project would be similar to those under the Proposed Action. Under Alternative B, the Forest Service would acquire Hay Lake Lands. The Pike River flows along the eastern boundary of the lands and could provide habitat for wood turtles.

No Action Alternative

There should be no direct or indirect effects to wood turtle under the No Action Alternative.

Cumulative Effects

Because of its dependence on forested riverine systems and well-drained soils, the wood turtle was probably never been uniformly distributed in the Upper Great Lakes Region, but was locally abundant in areas with optimal habitat. Throughout its range, many populations have become affected or extirpated by human activities. In Minnesota, factors contributing to its decline include the loss or fragmentation of riverine forests related to agriculture, timber harvest, road construction, and development; siltation of streams caused by excessive runoff; and flooding of nesting areas. Prime wood turtle habitat is attractive to recreationists, leading to increased collection and road kills. In addition, human activity attracts predators into areas because of trash left behind. An increase in predators can in turn affect wood turtle populations, with predators digging up nests or eating young turtles. All of these problems are compounded by the wood turtle's low reproductive potential, resulting in few juveniles recruited into the population (Bowen and Gillingham 2004, MDNR 2008).

Preservation of high-quality wood turtle habitat is dependent upon reasonable floodplain conservation techniques and zoning restrictions, including: maintaining water quality; controlling sedimentation; restricting pesticide use near waterways; enforcing minimum set-back requirements and stream-side buffer zones; and use of best management practices for timber harvest, livestock grazing, and agriculture. Limiting recreational use of streams in prime wood turtle habitat may be necessary to protect the habitat.

There should be no cumulative effects to wood turtles and their habitat from the Project as they have not been reported on the federal lands and mining activities would have no direct effects on the Partridge River, and indirect effects, such as changes in water flow and quality due to mining, should be negligible.

Both PolyMet and the Forest Service could conduct timber management activities on acquired lands. Cumulative effects from timber management should also be minor if the Forest Service follows guidance in its

2004 Forest Management Plan, and PolyMet and/or private landowners follow Minnesota Forest Resource Council (2003) forest management guidelines to protect riparian zones and streambanks.

Summary

Project activities associated with the Proposed Action and Alternative B should have no adverse direct or indirect effects on wood turtles. PolyMet, the Forest Service, and other landowners in the CESA could conduct timber management and other land-use activities in the reasonably foreseeable future that could have adverse cumulative effects on wood turtle habitat within the CESA, but this risk should be negligible if best management practices are followed to protect wood turtle habitat. There would be no direct or indirect effects to wood turtles or their habitats under the No Action Alternative.

5.2.5.2 Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for wood turtle. The No Action Alternative would have **no impact** to individuals of wood turtle.

5.2.5.3 Mitigation and Recommendations

No mitigation measures are recommended for the wood turtle.

5.2.6 Birds

Five RFSS birds have been observed on or near federal and/or non-federal lands and have suitable habitat on or near these lands —bald eagle, northern goshawk, boreal owl, great gray owl and three-toed woodpecker. In addition, these birds have not been observed, but there is suitable habitat for the following three RFSS birds on the federal and/or non-federal lands—olive-sided flycatcher, bay-breasted warbler, and Connecticut warbler.

5.2.6.1 Bald Eagle (*Haliaeetus leucocephalus*)

Environmental Baseline

The bald eagle was removed from the federal threatened species Endangered Species Act (ESA) list on June 28, 2007. After a period of decline due to hunting and widespread use of dichlorodiphenyltrichloroethane (DDT), bald eagle populations in the lower 48 states rose dramatically beginning in 1972. The bald eagle is federally protected by the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act.

Forest stands used for nesting (and perching) are typically mature trees within stands with uneven age structure. Second growth forest with 5% to 10% remnant old growth component provides breeding habitat in Minnesota. Nest trees are almost always taller than the surrounding vegetation, probably because it is difficult for such a large bird (especially inexperienced fledglings) to maneuver and take off in dense understories. However, nests are often built below the topmost branches, probably for protection from rain and sun. Bald eagles prefer old growth pine taller than the surrounding forest canopy, and on the Superior National Forest, nearly all nests are in eastern white pine or red pine.

Bald eagles typically use large trees within 500 feet of rivers or large lakes as nest sites and perches to search for fish and other prey. The MDNR NHIS database contains records of 18 nesting areas, some with multiple nests,

within 12 miles of the Project area. Some of these nests were in close proximity and were assumed to be used by a single pair. The five closest bald eagle nesting territories were 6 to 7.5 miles from the Project area and averaged 6 miles apart. No large lakes or large nesting trees are found on or near the Mine Site and it is unlikely that bald eagles would use the Mine Site.

The primary foraging habitats of bald eagles are the shorelines of lakes and rivers. The smallest body of water on which bald eagles were reported to nest was 20 acres on the Chippewa National Forest in Minnesota. Bald eagles nesting on smaller bodies of water may require additional foraging areas nearby. Nesting near small lakes usually means there is a larger lake or several smaller lakes nearby.

Bald eagles generally winter near open water where prey or carrion are available. There are no large open-water lakes on the federal lands. Mud Lake (30.5 acres) is the only open-water area on the federal lands, but it is shallow lake and freezes over during winter. Animal-vehicle collisions on Dunka Road and/or natural white-tailed deer or other wildlife mortality do not appear to produce sufficient carrion to sustain bald eagles on the federal lands (ENSR 2005), although the amount of carrion available to bald eagles during mine operations could increase due to increased levels of vehicle and rail traffic.

Wildlife surveys were conducted during the spring and summer on the federal lands in 2004, 2008, and 2009 (ENSR 2005, AECOM 2009, 2011a). No bald eagle nests were found on the federal lands, although a bald eagle was seen flying over the federal lands. Bald eagles or their nests were not observed on the non-federal lands (AECOM 2011b, c).

Direct and Indirect Effects

Proposed Action

There should be no direct or indirect effects to bald eagles from the Project on the federal lands. There are no large lakes or rivers on the Mine Site that would provide optimal nesting/foraging habitat, although the Partridge River (approximately 0.5 mile south of the federal lands), Mud Lake, and the ponds at the Tailings Basin associated with the Plant Site could provide some, though less-than-optimal, habitat.

The nearest known bald eagle nests to the federal lands are approximately 6 miles from the Project area. The U.S. Department of the Interior (USDOI) U.S. Fish and Wildlife Service (USFWS) *National Bald Eagle Management Guidelines* (USDOI USFWS 2007) suggest that human activity within 2 miles can be seen or heard by eagles and, depending on the level of screening and habituation of individual eagles, may cause them to abandon a nest.

Project noise would potentially have an impact on eagle utilization of habitat in the vicinity of the Mine Site. Existing ambient steady equivalent noise levels for most of the Mine Site are in the range of 35 to 45 decibels (dBA), which is a range comparable to secluded woods or a quiet bedroom (MPCA 1999). The Peter Mitchell Mine, north of the Mine Site, and traffic along Dunka Road and the existing railway, along the south edge of the Mine Site, also contribute brief, episodic noise impacts.

The primary sources of Project noise from the Mine Site would be blasting, haul trucks, and train horns, with noise levels ranging from 89-115 dBA. Equipment such as graders, bull dozers, and support trucks would be less dominant sources of noise, ranging from 75-95 dBA (Environmental Protection Agency 1971). Blasting at the Mine Site is expected to occur once every two to three days. Typically, rock blasting generates a single event

noise level ranging from 111- 115 dBA at 50 feet from the blasting site (Table 5.5-7 of Madera County 2005). Within most of the Mine Site, the sound from the blast would be similar to a loud clap of thunder.

The impacts of noise on bald eagle utilization of habitat near the Mine Site are largely unknown and the assessment of impacts remains subjective. Impacts may also vary between individual eagles. Some eagles may adapt to predictable human activities, so if the activity generally occurs at predictable time periods at the same places or along the same routes, animals may become habituated to the activity (ENSR/AECOM 2006).

Bald eagle nesting territories in Minnesota are, on average, about 10 miles apart. Bald eagle nests near the Project area average about 6 miles apart. This suggests that the area near the Project provides high quality habitat for bald eagles, but there is low likelihood that the area would support many more territories. As eagles become more numerous, any eagles seeking to establish new territories in the area would need to select lower quality habitat and/or move into closer proximity to human activity.

The Forest Service considers MIH 7, which is primarily red and white pine forest, indicative of bald eagle habitat. No stands of MIH 7 were observed on the federal lands or proposed Mine Site, although there are scattered pines on the federal lands.

Surface water contaminants (e.g., mercury) that are absorbed by prey species such as waterfowl could lead to ingestion of contamination by eagles (Marr 2008). However, bald eagles are relatively insensitive to the toxic effect of mercury exposure through their food (Judd 2013). In addition, the potential incremental change in fish mercury concentrations in lakes (e.g., Heikilla, Colby, Sabin, Whitewater, Wynne) potentially associated with the Project's air emissions is estimated to be small (ranges from 0.0006 to about 0.016 parts per million, about 0.2% to 1.6% of background; Barr 2013; Section 10). This potential change in fish mercury concentration would be within the variability of background fish mercury concentrations for the Hoyt Lakes area (Barr 2013: Section 10 and Attachment F). Because the potential change in fish mercury concentrations is estimated to be small and not likely statistically measurable (i.e., no measurable change from existing background conditions), the potential effect of Project-related mercury on the bald eagle would not likely be measurable. Overall, no adverse indirect effects to the bald eagle would be expected from the Project.

Under the land exchange, the Forest Service would acquire potential bald eagle habitat, but no areas with known bald eagle nests. The nearest bald eagle nest to Hay Lake Lands is about 4 miles to the southeast on Cedar Island Lake. Eagle nests have been observed at John Lake and at North Fowl Lake (two nests), about 2 to 3 miles from McFarland Lake Lands. It is likely that eagles use habitat associated with Pine Lake, which is near Wolf Lands 1 and Lake County Lands North; Greenwood Lake, which is near Wolf Lands 2; and the Stony River, which is near Wolf Lands 3 and 4.

Lakes and rivers that could be associated with eagle habitat are present on or near several of the non-federal lands. Hay Lake Lands include the Pike River, Hay Lake (96 acres), and Little Rice Lake (29 acres). Lake County Lands and Wolf Lands are near large lakes such as Pine and Greenwood. McFarland Lake Lands border McFarland Lake, which is connected to other lakes within the BWCAW, and bald eagles have been seen foraging on McFarland Lake (Russ 2010).

There are 2,582 acres of upland forest (MIH 1 and 5), which comprises about 40% of all habitat on the federal lands; 792 acres are mature forest habitat (**Table 6**). There are 2,775 acres of upland forest, which comprises about 39% of all habitat on the non-federal lands; 617 acres are mature forest habitat (**Table 6**). Jack pine, trembling aspen, paper birch, black spruce, and balsam fir are the dominant upland forest species on the federal

ANALYSIS AND DETERMINATION OF EFFECTS

lands. These species are also common on the non-federal lands, although there was less jack pine and more eastern white pine on the non-federal lands than on the federal lands.

The Project would affect about 1,037 acres of upland coniferous forest habitat, of which about 182 acres are mature upland forest habitat (**Table 6**). Only about 20% of upland forest stands on the non-federal lands consist of mature forest, which might include trees that could support bald eagle nests. Under the Proposed Action, the Forest Service would survey for bald eagles and associated habitat prior to conducting land-disturbing activities; areas of known or potential habitat would be avoided when feasible.

Alternative B

Potential direct and indirect effects to bald eagles from the Project would be similar to those under the Proposed Action. Under Alternative B, there are 2,093 acres of upland forest on the federal lands (**Table 6**). About 490 fewer acres of upland forest habitat would be transferred to PolyMet from the Forest Service under Alternative B than under the Proposed Action. Habitat loss from mining activities would be the same under Alternative B as under the Proposed Action.

The Forest Service would acquire Hay Lake Lands under Alternative B. There are no bald eagle nests and no known mature coniferous forest habitat on the lands. There are about 2,420 acres of upland forest habitat on Hay Lake Lands, however, only about 2% of this habitat is coniferous (MIH 5) and none of it is mature forest (**Table 6**). About 87% of the upland forest habitat that occurs on the non-federal lands is found on Hay Lake Lands. Thus, the Forest Service would receive most of the land that could provide habitat for bald eagles on the non-federal lands under the Proposed Action and Alternative B. Hay Lake, Little Rice Lake, and the Pike River are on Hay Lake Lands and may provide foraging habitat for bald eagles.

No Action Alternative

There should be no direct or indirect effects to bald eagle under the No Action Alternative.

Cumulative Effects

Human activity is the biggest threat to the bald eagle. Although DDT is no longer a risk factor in the U.S., organophosphates, heavy metals, and other pollutants continue to cause sickness or death in bald eagles. Lead poisoning is also a significant cause of mortality, and oil spills threaten eagles in coastal areas. Bald eagles are occasionally still shot or intentionally poisoned. Additionally, collisions with vehicles and power lines are a growing threat as more land is developed. Vehicle collisions have become more frequent as the bald eagle population has increased in Minnesota, due to the bald eagles habit of feeding on deer carcasses along roads. Land development in wilderness areas and along shorelines destroys breeding habitat and winter roost sites, and increased human activity may cause bald eagles to abandon nesting or winter roosting sites. However, the fact that bald eagles are now successfully nesting in proximity to humans, even in the Twin Cities metropolitan area, indicates that some bald eagles may become habituated to humans if they are not persecuted (USDA Forest Service 2004b).

Modeling to predict future vegetation management activities in Minnesota projected, under all scenarios modeled, that bald eagle nesting, roosting, and perching habitat will increase statewide. Red and eastern white pine forest acres, and the amount of old forests in both these forest types, are expected to increase. Cumulative

effects of forest management on all ownerships should benefit eagles by increasing preferred nesting, roosting, and perching habitat over the next several decades on both public and private lands (Jaakko Poyry 1994).

Adverse effects to bald eagles could occur on lands outside of Forest Service administration. Increases in the potential for human access near bald eagle territories would occur as people buy, subdivide, and develop private lands. New road construction would be needed to access this property. Some of these roads may be developed near to current or future nesting habitat. Development of cabins and second homes next to lakeshores could also decrease high quality eagle habitat through destruction of potential nesting habitat or indirectly through increases in disturbance associated with motorized recreation such as all-terrain vehicles and motorboats. Populations of fish, one of the primary types of prey species for eagle, may decrease on lakes with increased fishing pressure. Increasing fish populations through MDNR stocking would mitigate fish declines in some lakes (USDA Forest Service 2004b).

Relatively high deer populations across the landscape also are likely to pose potential adverse indirect cumulative effect on eagle. High deer populations are a result of factors (warm winters that increase survival, MDNR population management through hunting permits) that are outside the control of the Forest Service, and are the result of factors over which Forest Service has control (forest vegetation management for suitable deer habitat). With increasing deer populations and increasing numbers of road-killed deer, and forest management that promotes increasing deer habitat, this could result in greater potential for eagles to be killed or harmed along highways.

The Project could have minor cumulative effects, as there is mature forest habitat on the Mine Site that could be used by bald eagles. Bald eagles, however, were not observed using this habitat during wildlife surveys on the Mine Site. Both PolyMet and the Forest Service could conduct timber and other land management activities on their acquired lands. Cumulative effects from timber and other land management should be negligible if the Forest Service follows guidance in its 2004 Forest Plan (USDA Forest Service 2004a), and PolyMet and/or private landowners follow national bald eagle management guidelines developed by the USDOJ USFWS (2007).

Summary

Project activities associated with the Proposed Action and Alternative B should have no adverse direct or indirect effects on individual bald eagles or their habitat. There could be minor cumulative effects to bald eagle habitat, primarily from loss of mature forest habitat due to mining, but it is unlikely that these trees would be used by eagles in the near future. There would also be a cumulative loss of bald eagle habitat elsewhere in the CESA due to timber management, lakeside and other development, and other land use activities. Timber management and road construction could occur on the federal and non-federal lands in the reasonably foreseeable future, but only a small acreage of federal and non-federal lands would be affected.

Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for bald eagle. The No Action Alternative would have **no impact** to individuals of bald eagle.

Mitigation and Recommendations

No mitigation measures are recommended for the bald eagle.

5.2.6.2 Northern Goshawk (*Accipiter gentilis*)

Environmental Baseline

Northern goshawk is a large forest raptor that is found on boreal and temperate forests throughout the holarctic. Squires and Reynolds (1997) state that *Accipiter gentilis atricapillus*, the subspecies occurring in Minnesota, is widely distributed across the northern half of eastern North America and in many parts of western North America. Northern goshawks are generally uncommon throughout their range. Population productivity and nesting densities coincide with populations of snowshoe hare and grouse. Populations in the Great Lakes Region may have declined in the past due to early logging and settlement and extermination of passenger pigeons, a prey species for northern goshawk. In Wisconsin, the reintroduced fisher is blamed for increased nest failure and adult female mortality. Northern goshawk populations may be increasing with the recovery and maturing of forests in recent times in some parts of the U.S.

Northern goshawk is a forest dwelling raptor whose habitat preferences are mature deciduous or mixed coniferous/deciduous forest in fairly contiguous blocks intermixed with younger forests and openings for prey species habitat. Goshawks are adapted to flying beneath the forest canopy and use primarily mature forest with sufficient open space between the bottom live tree branches and understory for the birds to fly easily. Some understory (e.g., forbs) and downed logs are needed for prey species habitat. Adults and fledglings use large downed logs as feeding and plucking perches. Goshawks may use forest edge if large-bodied prey is more common there.

Boal et al. (2001 in USDA Forest Service 2010b) studied habitat use by nesting goshawks in northern Minnesota. Eighty-one percent of 46 nests were built in aspen trees, 11% in paper birch trees, 4% in white pine trees, and 2% each in red oak and red pine trees. On the Laurentian District, red pine plantations were the most common nest stands (four nests), followed by trembling aspen-black spruce-balsam fir (two nests), trembling aspen (one nest), jack pine (one nest), paper birch (one nest), and maple (one nest).

While goshawks do not always use the same nest for more than a year, they typically have two and up to nine alternate nest sites that are usually within a mile of the present nest. It is important to also protect these alternate nest sites that may be used in subsequent years.

Boal et al. (2001 in USDA Forest Service 2010b) found that foraging stands, regardless of stand type, were consistent in having high stand densities of tall, large canopy trees, with horizontal open spaces of 3 to 12 feet between the bottom of the overstory and top of the understory trees, and up to 3 feet between the bottom of the understory canopy and top of the shrub layer. They suggested that these relatively unobstructed spaces between vegetation layers may serve as important flight paths through forest stands, and the heights in which they occurred was consistent among stand types.

Calling surveys were conducted for northern goshawks on the federal lands (ENSR 2000, 2005, AECOM 2009, 2011a) and on Hay Lake Lands and McFarland Lake Lands (AECOM 2010b). One nest was found within the federal lands within the Mine Site in March 2000 (One Hundred Mile Swamp Territory; Ryan 2013a). The northern goshawk pair observed on the Mine Site used a large, 14 inches dbh trembling aspen tree as a nest, and

the midstory was mostly open in the vicinity of the nest. The surrounding forest stand was a mixture of deciduous and coniferous trees, and was near a recent clear-cut stand and a shrub swamp wetland. No goshawks were detected at the site during a 2004 survey (ENSR 2005). The territory was actively used by northern goshawks in 2005, but they did not nest. In 2006, the site was occupied by a great gray owl and there was a possible nest attempt by great gray owls in 2010 (Ryan 2013b).

In April 2009, a goshawk nest with a pair of goshawks at the nest was found near the boundary of the Mine Site (Wetlegs Creek Territory; AECOM 2009, Ryan 2013b). The occupied nest was located in the fork of a 12 inches dbh trembling aspen tree. The nest site area was characterized as a mixed coniferous/deciduous forest habitat, with numerous mature trembling aspen trees found in the forest stand. The nest site was in close proximity to a large bog wetland. In 2010, a barred owl used the nest at this location. In 2011, the nest was again used by northern goshawks. The nest was not occupied by goshawks during 2012, but in 2013 was again used by northern goshawks, although the nest attempt failed. A second nest was also found near the boundary of the Mine Site in 2009, but the nest was unoccupied and may have been an alternate goshawk nest or nest of another raptor or common raven.

A northern goshawk territory (Pike Mountain 2 Territory) is found near the southwestern boundary of Hay Lake Lands, and are probably used by the same pair (Ryan 2013b). The pair produced young in 2010, 2011, and 2013. No other northern goshawk nests have been found on or within a mile of the other non-federal lands, although northern goshawks have been seen within 3 miles of Lake County Lands South.

Direct and Indirect Effects

Proposed Action

There could be direct and indirect effects to northern goshawk from the Project. Two northern goshawk territories have been found on the federal lands, and northern goshawks nested on the federal lands in 2000, 2009, 2011, and 2013. Under the Proposed Action, the northern goshawk nest tree within the One Hundred Mile Swamp Territory on the Mine Site would no longer be available to northern goshawks, although the tree has not been used by northern goshawks since at least 2005.

Project noise would potentially have an impact on northern goshawk utilization of habitat in the vicinity of the Mine Site. Existing ambient steady equivalent noise levels for most of the Mine Site are in the range of 35 to 45 decibels (dBA), which is a range comparable to secluded woods or a quiet bedroom (MPCA 1999). The Peter Mitchell Mine, north of the Mine Site, and traffic along Dunka Road and the existing railway, along the south edge of the Mine Site, also contribute brief, episodic noise impacts.

The primary sources of Project noise from the Mine Site would be blasting, haul trucks, and train horns, with noise levels ranging from 89-115 dBA. Equipment such as graders, bull dozers, and support trucks would be less dominant sources of noise, ranging from 75-95 dBA (EPA 1971). Blasting at the Mine Site is expected to occur once every two to three days. Typically, rock blasting generates a single event noise level ranging from 111- 115 dBA at 50 feet from the blasting site (Table 5.5-7 of Madera County 2005). Within most of the Mine Site, the sound from the blast would be similar to a loud clap of thunder.

Noise and other disturbances on the Mine Site and Dunka Road and Utility Corridor could disturb northern goshawks nesting just off the Mine Site and on federal lands (Wetlegs Creek Territory), and possible cause them to abandon the territory. The Wetlegs Creek Territory nest site is about 0.75 miles from the Mine Site and

Dunka Road, and is buffered by forestland, which should help to minimize disturbance to the pair. Both territories are about 0.75 miles from the Northshore Mine property, where there is active mining, suggesting that northern goshawks nesting on the federal lands have habituated to disturbance from that mining operation.

Northern goshawks favor mature upland forest habitat (MIH 1). There are 557 acres of mature upland forest habitat within the federal lands that could provide habitat for the northern goshawks (**Table 6**). In addition, there are about 773 acres of young and immature upland forest habitat that could be used by northern goshawks in the future. The Project would affect about 158 acres of mature upland forest habitat, including mature trembling aspen habitat used by northern goshawks. In addition, about 375 acres of young and immature upland forest habitat would be lost to mining.

There are 591 acres of mature and 2,104 acres of young and immature upland forest habitat on the non-federal lands (**Table 6**). The non-federal lands would not be directly affected by the Project, but should benefit from Forest Service management that favors longer harvest rotations than typically occurs on private forestlands. Under the Proposed Action, the Forest Service would survey for northern goshawks and associated habitat prior to conducting land-disturbing activities; areas of known or potential habitat would be avoided when feasible.

Alternative B

Potential direct and indirect effects to northern goshawk from the Project under Alternative B would be similar to those under the Proposed Action. Under Alternative B, there are about 326 acres of mature and 628 acres of young and immature upland forest habitat on the federal lands (**Table 6**). About 230 fewer acres of mature and 145 acres of young and immature upland forest habitat on the federal lands would be transferred to PolyMet from the Forest Service under Alternative B than under the Proposed Action. Habitat loss to mining activities under Alternative B would be the same as under the Proposed Action.

The Forest Service would acquire Hay Lake Lands under Alternative B. There is a northern goshawk territory on Hay Lake Lands (Ryan 2013a). There are about 460 acres of mature and 1,906 acres of young and immature upland forest on Hay Lake Lands that could provide habitat for northern goshawk (**Table 6**). About 78% of mature, and 91% of young and immature, upland forest habitat that occurs on the non-federal lands is found on Hay Lake Lands. Thus, the Forest Service would receive most of the land that could provide habitat for northern goshawk on the non-federal lands under both the Proposed Action and Alternative B.

No Action Alternative

There would be no direct or indirect effects to northern goshawk under the No Action Alternative.

Cumulative Effects

Destruction or modification of habitat, habitat fragmentation, changes in vegetative structure and composition, and effects of activities associated with habitat modification are considered the primary threats to breeding northern goshawks (USDA Forest Service 2010b). Niemi and Hanowski (1992 in Jaakko Poyry Consulting, Inc. 1994)) suggested that northern goshawk prefer larger tracts of forest for foraging and are affected by fragmentation of forested areas. The species seldom uses recently cut areas for foraging, presumably because prey is hard to detect and capture in the dense understory. Another threat to northern goshawk is creation of landscape patterns (e.g., large openings from clear-cutting or increased edge habitat) that favor predators such as

red-tailed hawk, great-horned owl, fisher, or raccoon. In one study, stands larger than 50 acres were used more consistently by northern goshawk rather than stands smaller than 25 acres (Estabrook 2000).

State, county, and private forest management will likely reduce the present level of large blocks of mature upland forest found in the CESA. A 2008 Geographic Information System analysis shows a slight increase in mature upland forest on the Superior National Forest in recent decades, but the amount of mature/old upland forest is expected to decrease over the next several decades (USDA Forest Service 2010b). Fragmentation of larger blocks of habitat would make northern goshawks more vulnerable to predators and affect species distribution. Boal et al. (2001 *cited in* USDA Forest Service 2010b) documented up to 30% nest predation in northern Minnesota. Wide ranging pairs of northern goshawks may not successfully breed if they are forced to expand their home ranges to compensate for further loss of high quality foraging habitat.

There would be cumulative effects to northern goshawk habitat from the Project. About 158 acres of mature upland forest habitat that could be used by northern goshawk on the federal lands would be directly affected by the Project, including mature and other upland forest associated with the One Hundred Mile Swamp Territory, which was last used by northern goshawks in 2005 (**Table 6**). However, there are about 625,000 acres of upland forest within the CESA that could now, or in the reasonably foreseeable future, provide habitat for northern goshawk (Emmons and Olivier, Inc. 2006:30, 38). Thus, habitat loss from the Project would have a negligible cumulative effect on northern goshawks in the CESA.

Summary

Project activities associated with the Proposed Action and Alternative B would have no direct effects, but could have adverse indirect and cumulative effects to individual northern goshawks and their habitat. In particular, mining activities could disturb northern goshawks nesting on the Wetlegs Creek Territory, and remove habitat and prey and cause disturbance in areas where these birds may forage. Upland forest habitat used by northern goshawks is abundant in the CESA, and northern goshawks, although uncommon in the region, seem to have increased in numbers over the past several decades.

Timber management and road construction could occur on the federal and non-federal lands in the reasonably foreseeable future, but only a small acreage of federal and non-federal lands would be affected. It is more likely that production of mature upland forest habitat on the non-federal lands would occur if these lands are federally administered rather than under private ownership.

Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for northern goshawk. The No Action Alternative would have **no impact** to individuals of northern goshawk.

Mitigation and Recommendations

No mitigation measures are recommended for the northern goshawk.

5.2.6.3 Boreal Owl (*Aegolius funereus*)

Environmental Baseline

Hayward (1994) states that boreal owls occupy boreal forests throughout the northern hemisphere. East of the Rocky Mountains, breeding by boreal owls has only been confirmed in Minnesota and primarily in northeastern Minnesota. Nesting boreal owls are uncommon west of Highway 53 or the Vermillion River, or within 8 miles of Lake Superior. The prime area for boreal owls appears to be the eastern portion of the Forest Service Laurentian Ranger District, southern portion of the Kawishiwi Ranger District, and the middle portion of the Tofte Ranger District.

Boreal owls are rarely seen in Minnesota. The first one reported nesting in Minnesota was in 1978. Boreal owls have been documented as breeding in the Superior National Forest (USDA Forest Service 1999, Green 2003, Catton 2007), including a failed boreal owl nest in 2013 that was about 8 miles east/southeast of Wolf Lands 2 and 3 in Township 58 North, Range 9 West, Lake County, Minnesota (Ryan 2013c).

While attempts have been made to monitor boreal owl populations, present survey techniques are not sufficiently precise to detect population trends for northern Minnesota. Boreal owl populations fluctuate with winter snow depth and prey availability, and winter population irruptions occur periodically. There appears to be an influx of boreal owls into northern Minnesota every 4 years, perhaps due to a decline in their prey (vole) populations further north in Canada. The latest influx was in winter 2013, with several boreal owls sighted near Duluth. The population on the Superior National Forest is part of a larger Canadian population and may not be viable by itself at present.

Boreal owls prefer forests dominated by black spruce, white spruce, balsam fir, balsam poplar, trembling aspen, and paper birch. They favor mature forest during winter because snow conditions (un-crusted snow) facilitate access to prey. In summer, mature forest sites have less herbaceous cover than open sites, allowing greater access to prey. Following spring thaw, before herbaceous vegetation becomes dense, owls shift to openings where densities of voles exceed densities in forested stands.

Nesting habitat is mixed coniferous/deciduous upland forest usually older than 70 years. Nest trees are typically trembling aspen and paper birch with an average 16 to 18 inches dbh. Cavities excavated by pileated woodpeckers are often used for nesting by the boreal owl. Within 8 acres centered on each nest site, another important habitat component is six or more dominant or co-dominant conifers that are used as calling perches. Nest sites are usually within 200 yards of large areas of productive mature lowland conifers, primarily black spruce, which are preferred for foraging and roosting. Nests that are further than 200 yards from lowland conifer forest typically have a mature forest corridor to that lowland coniferous forest. Populations are limited by availability of cavities for nesting and food supply. Limiting factors may be the right combination of nesting and foraging/roosting habitat, and possibly the distribution of these habitats and cavity trees. Fragmentation has been a primary factor causing the isolation of lowland coniferous forests. Other limiting factors include automobile collisions and low prey density.

Night calling surveys for boreal owls were conducted on the federal lands during winter and early spring 2000, summer 2004, summer 2008, and spring 2009 by broadcasting pre-recorded boreal owl calls; no boreal owls were heard during the surveys (ENSR 2000, 2005, AECOM 2009, 2011a). A boreal owl was heard along the Dunka Road during surveys in 1988 to 1989 (ENSR 2000). Surveys were also conducted on the non-federal

lands, but no boreal owls were heard (AECOM 2011b, c), although a boreal owl nest was found by the Forest Service in 2013 about 8 miles east/southeast of Wolf Lands 2 and 3 (Ryan 2013c).

Direct and Indirect Effects

Proposed Action

There should be no direct effects to boreal owls on the federal lands from the Project as no boreal owls are known to use the federal lands. Boreal owls could use the federal lands, however, and mining activities could disturb boreal owls on or near the Mine Site and Dunka Road and Utility Corridor and indirectly affect their habitat use.

The Project would cause the loss of potential boreal owl foraging habitat (lowland black spruce and mixed swamp coniferous stands greater than 50 years old) and nesting habitat (upland deciduous forest habitat greater than 70 years old; USDA Forest Service 2010b). There are about 3,040 acres of mature lowland coniferous forest (MIH 9) and about 557 acres of mature upland forest habitat (MIH 1) on the federal lands that could provide habitat for boreal owls (**Table 6**). In addition, there are about 773 acres of young and immature upland forest habitat that could be used by boreal owls in the future. The Project would affect about 482 acres of mature lowland coniferous forest, 158 acres of mature upland forest, and 375 acres of young and immature upland forest habitat (**Table 6**). No young or immature lowland coniferous forest habitat would be affected by the Project.

Boreal owls have not been recorded on the non-federal lands in recent years, but a boreal owl nest was found by the Forest Service in 2013 about 8 miles east/southeast of Wolf Lands 2 and 3 (Ryan 2013c). There are about 1,208 acres of mature and 2,101 acres of young and immature lowland coniferous forest habitat, and about 591 acres of mature and 2,104 acres of young and immature upland forest habitat, on the non-federal lands (**Table 6**). Thus, there could be suitable boreal owl foraging habitat (mature lowland coniferous forest) and nesting habitat (mature upland forest) on the non-federal lands. These lands would not be directly affected by the Project. This habitat could be maintained through the retention of mature patches greater than 300 acres, limited black spruce harvest, riparian management, and by leaving large trembling aspen/paper birch as reserve trees and positioning reserve areas along the wetland/upland interface. Under the Proposed Action, the Forest Service would survey for boreal owls and associated habitat prior to conducting land-disturbing activities and areas of known or potential habitat would be avoided when feasible. The Forest Service would also monitor boreal owl use of these lands and seek to protect larger patches of high quality habitat for boreal owls.

Alternative B

Effects to boreal owl under Alternative B should be similar to those under the Proposed Action. Under Alternative B, there are about 2,063 acres of mature and 16 acres of young and immature lowland coniferous forest habitat and 326 acres of mature and 628 acres of young and immature upland forest on the federal lands (**Table 6**). About 977 fewer acres of mature lowland coniferous forest and 231 fewer acres of mature upland forest would be transferred to PolyMet from the Forest Service than under the Proposed Action. Habitat loss to mining activities would be the same under Alternative B as under the Proposed Action.

The Forest Service would acquire Hay Lake Lands under Alternative B. No boreal owls have been observed in recent years on these lands. There are 0 acres of mature and 1,818 acres of young and immature lowland coniferous forest habitat, and 460 acres of mature and 1,906 acres of young and immature upland deciduous

ANALYSIS AND DETERMINATION OF EFFECTS

forest habitat on Hay Lake Lands. About 87% of the lowland coniferous forest habitat and 78% of the mature upland forest habitat that occurs on the non-federal lands are found on Hay Lake Lands.

No Action Alternative

There would be no direct or indirect effects to boreal owl under the No Action Alternative.

Cumulative Effects

The Final Generic Environmental Impact Statement Study on Timber Harvesting and Forest Management in Minnesota (Jaakko Poyry Consulting Inc. 1994) projected a decrease in the Minnesota boreal owl population if statewide timber harvest increased over 1 million cords overall or about 25% higher than at present. On federal lands, there is anticipated to be a reduction in mature upland patches (less than 300 acres) and a reduction in interior forest, but also an increase in mature lowland patches greater than 300 acres. Harvest by other landowners has the potential to further reduce boreal owl nesting, and to a lesser extent, foraging habitat.

The 2008 Superior National Forest-wide monitoring showed a slight increase in mature upland deciduous and coniferous habitat, and a slight decrease in mature lowland coniferous forest for the Superior National Forest (USDA Forest Service 2010b). Monitoring also showed a slight increase in mature upland forest on the Superior National Forest in recent decades, but the amount of mature upland forest is expected to decrease over the next several decades. State, county, and private forest management will probably reduce the present level of large blocks of mature upland forest found on the CESA.

There should be no cumulative effects to individual boreal owls from the Project, but there would be a cumulative loss of potential boreal owl habitat. About 640 acres of mature lowland coniferous forest and upland deciduous forest habitat that could be used by this species on the federal lands would be directly affected by the Project. However, there are about 820,000 acres of upland deciduous and lowland coniferous forest within the CESA that could now, or in the reasonably foreseeable future, provide habitat for boreal owls (Emmons and Olivier, Inc. 2006; 30, 38). Thus, habitat loss from the Project would have a negligible cumulative effect on boreal owls in the CESA.

Summary

Project activities associated with the Proposed Action and Alternative B should have no adverse direct or cumulative effects on individual boreal owls, but could have direct, indirect, or cumulative effects on their habitat. Mining activities could disturb boreal owls on or near the Mine Site and Dunka Road and Utility Corridor and indirectly affect their habitat use. Timber management and road construction could occur on lands within the CESA in the reasonably foreseeable future, but only a small acreage of federal and non-federal lands would be affected. It is more likely that production of mature lowland and upland forest habitat on the non-federal lands would occur if these lands are federally administered rather than under private ownership.

Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for boreal owl. The No Action Alternative would have **no impact** to individuals of boreal owl.

Mitigation and Recommendations

No mitigation measures are recommended for boreal owl.

5.2.6.4 Great Gray Owl (*Strix nebulosa*)

Environmental Baseline

The great gray owl has a holarctic distribution and breeds in the western U.S. and in the northern Great Lakes Region. Great gray owls forage anywhere meadow voles are abundant and available. Meadow vole abundance is influenced by season (more numerous in late summer and fall), a 3- to 5-year cycle in Minnesota, and habitat capacity. The great gray owl prefers moist soils and relatively open areas with high primary production of prey. Nesting commonly occurs in mature trembling aspen adjacent to muskegs. Minimum nest stand size was 10 acres in Manitoba and 27 acres in Alberta. Foraging occurs in open habitat, including bogs, selective and clear-cut logged areas with residual perches, natural meadows, and open forests within 1.5 miles of the nest. Perches need not be tall and can be high stumps, broken-off trees, and the short black spruce found in peatland bogs. Meadow voles that are 50 feet or more from a perch or forest edge are usually not available to great gray owls. Great gray owls avoid jack pine, taller black spruce, dense forest cover, large open treeless areas without perches, and habitats with a dense shrub layer. They also avoid concentrations of predators such as great horned owls. Average home range size for breeding adults was 1.7 square miles (mi²) in Oregon. A Minnesota study found eight nests in 20 mi².

Kozie (1999) recommended the following forestry practices to maintain or enhance great gray owl habitat: 1) restriction of harvest unit size to less than 25 acres with a mosaic of multi-sized units, 2) retention of forest stands within 900 feet of known or potential nest trees or sites, 3) provision of hunting perches in clearcuts, 4) ensuring irregularly shaped harvest units with a maximum distance across the cut of less than 300 feet, and 5) maintenance of forested travel corridors, 150 to 300 feet wide, between cut areas. In the Pacific Northwest, the Forest Service recommended providing a no-harvest buffer of about 300 feet around meadows and natural openings and establishment of a 1,320-foot protection zone (125 acres) around nest trees. Kozie (1999) also recommended placing priority on maintaining nesting habitat within 0.5 to 1.5 miles of natural openings rather than clear-cuts.

Night calling surveys did not identify great gray owls on the federal lands (ENSR 2000, 2005, AECOM 2009, 2011a). During 2009 surveys, however, a great gray owl was observed hunting along Dunka Road south of the Mine Site. Based on Forest Service observations, a great gray owl pair was seen using a nest site on the Mine Site in 2006, and possibly in 2010. The nesting effort(s) were unsuccessful. This was the same nest site used by northern goshawks in 2000 (ENSR 2000; Ryan 2013b). In 2011, a great gray owl was seen using a nest site on the federal lands surrounding the Mine Site and near a nest used by northern goshawks (Wetlegs Creek Territory).

Calling surveys did not identify great gray owls on the non-federal lands (AECOM 2011b, c). Great gray owls were surveyed on the Tracks Project area in 2007 and 2008 using both call playback and listening stops. Five survey routes were run and consisted of 50 survey points along roads. These routes were run two to four times in the spring both years. No great gray owls were detected within the Tracks Project area.

Direct and Indirect Effects

Proposed Action

Great gray owls were seen nesting on the Mine Site in 2006, and foraging along the Dunka Road in 2009. If the Mine Site is part of the territory of a great gray owl, mining activities could directly affect great gray owls by disrupting their use of this area, and indirectly affect owls through removal of a tree that has provided a nest site for great gray owls in the past, removal of foraging habitat and prey, and from Mine Site and Dunka Road and Utility Corridor disturbances. Great gray owls have been seen perching near the Plant Site entrance on light poles, and foraging and perching on trees within 100 feet of the Dunka Road. Thus, great gray owls seem tolerant of some human disturbance (AECOM 2009).

Project noise would potentially have an impact on eagle utilization of habitat in the vicinity of the Mine Site. Existing ambient steady equivalent noise levels for most of the Mine Site are in the range of 35 to 45 decibels (dBA), which is a range comparable to secluded woods or a quiet bedroom (MPCA 1999). The Peter Mitchell Mine, north of the Mine Site, and traffic along Dunka Road and the existing railway, along the south edge of the Mine Site, also contribute brief, episodic noise impacts.

The primary sources of Project noise from the Mine Site would be blasting, haul trucks, and train horns, with noise levels ranging from 89-115 dBA. Equipment such as graders, bull dozers, and support trucks would be less dominant sources of noise, ranging from 75-95 dBA (EPA 1971). Blasting at the Mine Site is expected to occur once every two to three days. Typically, rock blasting generates a single event noise level ranging from 111- 115 dBA at 50 feet from the blasting site (Table 5.5-7 of Madera County 2005). Within most of the Mine Site, the sound from the blast would be similar to a loud clap of thunder.

The impacts of noise on great gray owl utilization of habitat near the Mine Site are largely unknown and the assessment of impacts remains subjective, although as noted above, great gray owls appear to be tolerant of human disturbance. Impacts may also vary between individual owls. Some may adapt to predictable human activities, so if the activity generally occurs at predictable time periods at the same places or along the same routes, individual great gray owls may become habituated to the activity (ENSR/AECOM 2006).

Mature upland forest (MIH 1) is indicative of nesting habitat, while foraging habitat consists of young upland forest and lowland coniferous forest (MIH 9). Non-forest (upland and lowland) also provides foraging habitat. There are about 233 acres of young and 557 acres of mature upland forest habitat, 3,060 acres of lowland coniferous habitat, and 492 acres of lowland shrubland (MIH – other lowland shrub) on the federal lands that could provide habitat for great gray owls (**Table 6**). The Project would affect about 144 acres of young and 158 acres of mature upland forest habitat. In addition, about 482 acres of lowland coniferous forest habitat and 141 acres of shrubland would be lost to mining (**Table 6**).

There are about 607 acres of young and 591 acres of mature upland forest habitat, 3,309 acres of lowland coniferous forest habitat, and 332 acres of lowland shrubland habitat on the non-federal lands (**Table 6**).

There is abundant great gray owl foraging habitat and nesting habitat on the non-federal lands. These lands would not be directly affected by the Project. This habitat would be maintained through the retention of mature patches greater than 300 acres, limited black spruce harvest, riparian management, and in harvest units by leaving large trembling aspen/paper birch as reserve trees and positioning reserve areas along the wetland/upland interface. Under the Proposed Action, the Forest Service would survey for great gray owls and

associated habitat prior to conducting land-disturbing activities and areas of known or potential habitat would be avoided when feasible.

Alternative B

Potential direct and indirect effects to great gray owl from the Project would be similar to those under the Proposed Action. Under Alternative B, there are about 233 acres of young and 326 acres of mature upland forest, 2,079 acres of lowland coniferous forest, and 385 acres of lowland shrubland on the federal lands (**Table 6**). About 230 fewer acres of upland forest, 982 fewer acres of lowland coniferous forest, and 107 fewer acres of lowland shrubland would be transferred to PolyMet from the Forest Service under Alternative B than under the Proposed Action. This area would provide habitat for great gray owls, although noise and other disturbance associated with mining may discourage use of the area by great gray owls.

The Forest Service would acquire Hay Lake Lands under Alternative B. No great gray owls have been reported on these lands. There are about 519 acres of young and 460 acres of mature upland forest, 1,818 acres of lowland coniferous forest, and 113 acres of lowland shrubland habitat on Hay Lake Lands (**Table 6**). About 85% of young and 78% of mature upland forest, 55% of lowland coniferous forest habitat, and 34% of lowland shrubland habitat that occurs on the non-federal lands are found on Hay Lake Lands. A portion of Hay Lake Lands could be administered as a Candidate Research Natural Area, to the potential benefit of great gray owls. As noted in Section 5.2.6.2, a northern goshawk territory is found in the southwestern portion of Hay Lake Lands. Great gray owls show a propensity to use northern goshawk nests, and could use the nest sites on Hay Lake Lands in the future.

No Action Alternative

There would be no direct or indirect effects to great gray owl under the No Action Alternative.

Cumulative Effects

As discussed for boreal owls, reasonably foreseeable future land and timber management activities in the CESA could result in a loss of some habitat for owls in Minnesota. Logging in nesting habitat could affect the great gray owl under the Proposed Action, Alternative B, and No Action Alternative by removing suitable nesting structure. Despite the fact that timber harvest can remove nesting habitat, harvest can create more temporary foraging habitat in some coniferous forest types. Maintaining large mature patches of upland forest would help to ensure suitable interior nesting habitat would be available across the landscape. Implementation of Minnesota Forest Resources Council's (1999) Voluntary Site-Level Forest Management Guidelines would help to ensure that snags, reserve trees, and downed wood are provided in all harvested stands.

Roads and recreation projects should have a minimal effect on great gray owls. Owls readily forage along roadsides. Many of the proposed roads use existing road corridors which are not owl nesting habitat. Wetlands would be avoided whenever possible. Prescribed burning should not have an effect on great gray owls unless there was a nest present in the stand.

About 925 acres of young and mature upland forest, lowland coniferous forest, and shrubland that could be used as nesting and foraging habitat for this species on the federal lands would be directly affected by the Project (**Table 6**). However, there are about 980,000 acres of upland forest, and lowland coniferous forest and shrubland, within the CESA that could now, or in the reasonably foreseeable future, provide habitat for great

gray owls (Emmons and Olivier, Inc. 2006:30, 38). Thus, habitat loss from the Project would have a negligible cumulative effect on great gray owls in the CESA.

Summary

Project activities associated with the Proposed Action and Alternative B should have no adverse direct, indirect, or cumulative effects on individual great gray owls, but could have direct, indirect, or cumulative effects on their habitat. Timber management and road construction could occur on the lands within the CESA in the reasonably foreseeable future, but only a small acreage of federal and non-federal lands would be affected. It is more likely that production of mature lowland and upland forest habitat on the non-federal lands would occur if these lands are federally administered rather than under private ownership.

Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for great gray owl. The No Action Alternative would have **no impact** to individuals of great gray owl.

Mitigation and Recommendations

No mitigation measures are recommended for great gray owl.

5.2.6.5 Three-toed Woodpecker (*Picoides tridactylus*)

Environmental Baseline

Three-toed woodpecker is a species of boreal and montane coniferous forests and is primarily a resident species throughout its range (Burdett 2002 and references cited therein). It usually inhabits mature or old-growth lowland coniferous stands with abundant insect-infected dead and dying trees. Even in predominately living forests, three-toed woodpeckers forage mainly on dead and dying timber. Three-toed woodpeckers breed throughout lowland coniferous forests in Canada and the western U.S., and in northern Minnesota and Wisconsin. Population trends are unknown. In the Superior National Forest, they seem to nest mainly in black spruce and balsam fir snags and mature trees. This dependence on insect-infected dead and dying timber frequently results in populations showing an association with forest disturbances such as fire, wind-throw, floods, insect outbreaks, and disease. In particular, three-toed woodpecker populations often show an increased abundance in early post-fire successional areas (Burdett 2002). Black spruce and tamarack stands are the vegetation community most likely to contain three-toed woodpeckers in Minnesota.

Habitat for the three-toed woodpecker is conifers killed by fire, beetles, partial wind-throw, or flooding. The bird keys in on beetles that feed on dead trees 1 to 5 years after trees are killed. A limiting factor for the three-toed woodpecker is foraging habitat where sufficient insects can be found to feed its young during the breeding season. This species can be nomadic and shift over large portions of the landscape depending on habitat conditions. Promotion of conifers and retaining residual trees (preferably long-lived, wind-firm conifers) in large openings may maintain or enhance habitat conditions for three-toed woodpeckers. Studies have also found that they are more likely to occur in larger areas of virgin forest versus smaller patches, suggesting forest fragmentation may adversely affect the three-toed woodpecker population.

ENSR (2000, 2005) and AECOM (2011a) conducted visual and calling surveys for woodpeckers on the federal lands. One three-toed woodpecker was observed foraging on black spruce snags during winter field surveys on the Mine Site in 2000 (ENSR 2000). A three-toed woodpecker was also seen on the Mine Site by Forest Service personnel in 2007. AECOM (2011b, c) conducted calling and visual surveys for three-toed woodpeckers on the non-federal lands, but no three-toed woodpeckers were seen or heard.

The Natural Resources Research Institute's (NRRI) Breeding Bird Monitoring effort surveys 169 forest stands on the Superior National Forest. The Institute did not detect three-toed woodpeckers on the Superior National Forest; however, timing and location of survey routes are such that this species is not adequately surveyed (USDA Forest Service 2010b). No three-toed woodpeckers were observed on the Tracks Project area.

Direct and Indirect Effects

Proposed Action

A three-toed woodpecker was identified on the federal lands during surveys in 2000 and was observed on the lands again in 2007. Though not surveyed, the Transportation and Utility Corridors and Plant Site lack the old-growth forest or recent burn habitat preferred by the three-toed woodpecker. This species is sensitive to disturbance and would not be expected to use the Mine Site, Transportation and Utility Corridors, or the Plant Site, although observations of three-toed woodpecker in 2000 were made within one-half mile of an active exploration drill rig (ENSR 2005).

Project noise would potentially have an impact on eagle utilization of habitat in the vicinity of the Mine Site. Existing ambient steady equivalent noise levels for most of the Mine Site are in the range of 35 to 45 decibels (dBA), which is a range comparable to secluded woods or a quiet bedroom (MPCA 1999). The Peter Mitchell Mine, north of the Mine Site, and traffic along Dunka Road and the existing railway, along the south edge of the Mine Site, also contribute brief, episodic noise impacts.

The primary sources of Project noise from the Mine Site would be blasting, haul trucks, and train horns, with noise levels ranging from 89-115 dBA. Equipment such as graders, bull dozers, and support trucks would be less dominant sources of noise, ranging from 75-95 dBA (EPA 1971). Blasting at the Mine Site is expected to occur once every two to three days. Typically, rock blasting generates a single event noise level ranging from 111- 115 dBA at 50 feet from the blasting site (Table 5.5-7 of Madera County 2005). Within most of the Mine Site, the sound from the blast would be similar to a loud clap of thunder.

The impacts of noise on three-toed woodpecker utilization of habitat near the Mine Site are largely unknown and the assessment of impacts remains subjective, although as noted above, three-toed woodpeckers appear to be sensitive to human disturbance. Impacts may also vary between individual three-toed woodpeckers.

Three-toed woodpeckers favor lowland black spruce forest and areas with snags. There are about 3,040 acres of mature lowland coniferous habitat (MIH 9) on the federal lands that could provide habitat for three-toed woodpeckers (**Table 6**). AECOM (2005) found about 80 acres associated with the Partridge River that had been flooded, killing spruce trees and creating snag habitat. The Project would affect about 482 acres of mature lowland coniferous habitat. This includes pockets of snag habitat within wetlands.

There are about 1,208 acres of mature lowland coniferous forest habitat on the non-federal lands (**Table 6**). AECOM found about 45 acres of black spruce snags associated with forests that had been flooded by beavers,

which kills trees (AECOM 2011b, c). These lands would not be directly affected by the Project. Under the Proposed Action, the Forest Service would survey for three-toed woodpeckers and associated habitat prior to conducting land-disturbing activities and areas of known or potential habitat would be avoided when feasible.

Alternative B

Potential direct and indirect effects to three-toed woodpeckers from the Project would be similar to those under the Proposed Action. Under Alternative B, there are about 2,063 acres of mature lowland forest on the federal lands (**Table 6**). About 977 fewer acres of mature lowland coniferous forest would be transferred to PolyMet from the Forest Service under Alternative B than under the Proposed Action. This area could provide habitat for three-toed woodpeckers, although noise and other disturbance associated with mining could discourage use of the area by three-toed woodpeckers.

The Forest Service would acquire Hay Lake Lands under Alternative B. No three-toed woodpeckers were seen on these lands during wildlife surveys. There are about 1,818 acres of lowland coniferous forest habitat on Hay Lake Lands, although none of this habitat contains mature forest (**Table 6**). About 55% of the lowland coniferous forest that occurs on the non-federal lands is found on Hay Lake Lands. There are about 45 acres of black spruce snag habitat on Hay Lake Lands (AECOM 2011b). Thus, there would be limited foraging and nesting habitat for three-toed woodpeckers on Hay Lake Lands.

No Action Alternative

There would be no direct or indirect effects to three-toed woodpecker under the No Action Alternative.

Cumulative Effects

Threats facing the three-toed woodpecker include habitat loss and fragmentation, fire suppression, salvage logging, conifer conversion to aspen, beaver control, and poor snag retention policies. Historically, natural fire regimes in mature conifer and large amounts of old-growth forest would have created abundant foraging habitat for three-toed woodpeckers prior to European settlement. Clearing of the forests and fire suppression after settlement would have started to reduce habitat for this species.

Forest management that removes conifers that have the potential to have high populations of insects, especially wood-boring beetles, is detrimental to the three-toed woodpecker. Practices that increase the amount of mature lowland coniferous forest would benefit this species.

Other ownerships (especially the State of Minnesota) have started converting some trembling aspen stands to coniferous stands, which should help increase habitat. Beaver populations may increase and thereby increase three-toed woodpecker habitat (flood-killed trees). Recent large fires on the Superior National Forest in the past few years have produced good habitat. Prescribed burning may be beneficial to this species if it leads to some mortality of overstory trees.

About 482 acres of mature lowland coniferous forest that could be used by this species on the federal lands would be directly affected by the Project (**Table 6**). However, there are about 356,000 acres of lowland coniferous forest/shrubland within the CESA that could now, or in the reasonably foreseeable future, provide habitat for three-toed woodpeckers (Emmons and Olivier, Inc. 2006:30, 38). Thus, habitat loss from the Project would have a negligible cumulative effect on three-toed woodpeckers in the CESA.

Summary

Project activities associated with the Proposed Action and Alternative B could have adverse direct, indirect, or cumulative effects on three-toed woodpeckers and their habitat. Few three-toed woodpeckers use the federal lands. Timber management and road construction could occur on the lands in the reasonably foreseeable future, but only a small acreage of federal and non-federal lands would be affected. It is more likely that production of mature lowland habitat on the non-federal lands would occur if these lands are federally administered rather than under private ownership.

Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for three-toed woodpecker. The No Action Alternative would have **no impact** to individuals of three-toed woodpecker.

Mitigation and Recommendations

No mitigation measures are recommended for three-toed woodpecker.

5.2.6.6 Olive-sided flycatcher (*Contopus cooperi*)

Environmental Baseline

The olive-sided flycatcher has a large breeding range that includes the wooded areas of Canada, Alaska, and the western and northeastern U.S. While secure in some places, the Breeding Bird Survey data for North America shows the species declined 5% per year between 1986 and 1998 nationally, and more than 1.5% per year in northern Minnesota between 1966 and 1996 (USDA Forest Service 2010b, Sauer et al. 2012).

No olive-sided flycatchers were seen during surveys of the federal and non-federal lands, although surveys were conducted on the Hunting Club, Lake County, and Wolf Lands during late fall after flycatchers had migrated south for the winter (ENSR 2000, 2005, AECOM 2011a, b, c). A few individuals are detected each year on songbird monitoring plots in the Superior National Forest, but numbers are not large enough to estimate population trends. An average of 1.7 and 0.2 olive-sided flycatchers have been recorded on the Jordan and Hart Lake Breeding Bird Survey routes, respectively, each year since 1966. The Jordan route is about 20 miles southeast of the federal lands and the Hart Lake route is about 20 miles south of the federal lands; these routes are the closest survey routes to the federal lands. Two olive-sided flycatchers were recorded during the Tracks Project area Breeding Bird Surveys in 2008.

The NRRI's Breeding Bird Monitoring effort surveys 169 forest stands on the Superior National Forest. Olive-sided flycatchers have been detected in 37 forest stands on the Superior National Forest. However, detections are rare and irregular, with only 1 detection in 20 forest stands during the period between 1991 and 2005. A nesting olive-sided flycatcher was reported on the Gunflint Ranger District in 2005.

Olive-sided flycatchers nest most frequently in larger black spruce-tamarack bogs or in large openings with scattered trees. MacLean (1999) found olive-sided flycatchers using burned or cleared areas with standing trees, primarily conifers. Beaver ponds provide important habitat with flood-killed trees. Timber harvest does not provide habitat if it results in an even-aged stand with little variation in canopy height, or few dead standing

trees. At least 50 acres of habitat may be needed to support a single territorial pair of olive-sided flycatchers. The primary threat to the species, however, appears to be destruction of wintering habitats in the Andes of South America.

Direct and Indirect Effects

Proposed Action

Olive-sided flycatchers favor lowland black spruce/tamarack bogs, but also use upland coniferous forest. There are 3,060 acres of lowland coniferous forest (MIH 9) and 1,252 acres of upland coniferous habitat (MIH 5) on the federal lands that could provide habitat for the olive-sided flycatchers (**Table 6**). The Project would affect about 482 acres of lowland coniferous and 505 acres of upland coniferous habitat. After mining, about 397 acres would be reclaimed to wetland/grassland/shrubland habitat that, over time, would become upland and lowland coniferous and deciduous habitat that could be used by olive-sided flycatchers (MDNR et al. 2013).

There are about 3,309 acres of lowland coniferous forest, but only 80 acres of upland coniferous forest habitat on the non-federal lands (**Table 6**). These lands would not be directly affected by the Project. Under the Proposed Action, the Forest Service would survey for olive-sided flycatchers and associated habitat prior to conducting land-disturbing activities and areas of known or potential habitat would be avoided when feasible.

Alternative B

Potential direct and indirect effects to olive-sided flycatchers from the Project would be similar to those under the Proposed Action. Under Alternative B, there are 2,079 acres of lowland coniferous forest and 1,139 acres of upland coniferous habitat on the federal lands (**Table 6**). About 981 fewer acres of lowland coniferous forest and 113 fewer acres of upland coniferous forest on the federal lands would be transferred to PolyMet under Alternative B. This area could provide habitat for olive-sided flycatchers, although noise and other disturbance associated with mining may discourage use of the area by olive-sided flycatchers.

The Forest Service would acquire Hay Lake Lands under Alternative B. There are about 1,818 acres of lowland coniferous forest and 54 acres of upland coniferous forest habitat on Hay Lake Lands (**Table 6**). About 55% of the lowland coniferous forest and 68% of the upland coniferous forest that occurs on the non-federal lands is found on Hay Lake Lands. No olive-sided flycatchers were seen on these lands during wildlife surveys, although olive-sided flycatchers were seen on the nearby Tracks Project area and Breeding Bird Survey routes.

No Action Alternative

There would be no direct or indirect effects to olive-sided flycatcher under the No Action Alternative.

Cumulative Effects

Threats facing this species are similar to those for species, such as the three-toed woodpecker and boreal owl, that use lowland black spruce/tamarack bog habitat, including habitat loss and fragmentation, fire suppression, salvage logging of fire-killed trees, conifer conversion to aspen, beaver control, and clear-cutting that leaves few residual trees or little variety in canopy structure. Historically, natural fire regimes in mature coniferous forest and large amounts of old-growth forest would have created abundant foraging habitat for olive-sided

flycatchers prior to European settlement. Clearing of the forests and fire suppression after settlement would have started to reduce habitat for this species.

Other ownerships (especially the State) have started converting some trembling aspen stands to coniferous stands, which should help increase habitat. Beaver populations may increase and thereby increase olive-sided flycatchers' habitat (flood-killed trees). Recent large fires on the Superior National Forest in the past few years have produced good habitat. Prescribed burning may be beneficial to this species if it leads to some mortality of overstory trees.

About 482 acres of lowland coniferous forest (MIH 9) and 505 acres of upland coniferous forest habitat (MIH 5) that could be used by this species on the federal lands would be lost due to the Project (**Table 6**). However, there are about 356,000 acres of lowland coniferous forest and about 161,000 acres of upland coniferous forest within the CESA that could now, or in the reasonably foreseeable future, provide habitat for olive-sided flycatchers (Emmons and Olivier, Inc. 2006:30, 38). Thus, habitat loss from the Project would have a negligible cumulative effect on olive-sided flycatchers in the CESA.

Summary

Project activities associated with the Proposed Action and Alternative B should have no adverse direct, indirect, or cumulative effects on individual olive-sided flycatchers, but could have direct, indirect, or cumulative effects on their habitat. Timber management and road construction could occur on the lands in the reasonably foreseeable future, but only a small acreage of federal and non-federal lands would be affected. It is more likely that production of immature and mature lowland habitat, prescribed burnings that leave standing dead trees, and partial cuts, on the non-federal lands could occur if these lands are federally administered rather than under private ownership.

Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for olive-sided flycatcher. The No Action Alternative would have **no impact** to individuals of olive-sided flycatcher.

Mitigation and Recommendations

No mitigation measures are recommended for olive-sided flycatcher.

5.2.6.7 Bay-breasted Warbler (*Dendroica castanea*)

Environmental Baseline

Bay-breasted warbler is a neotropical migrant that breeds throughout the black spruce-balsam fir forest of Canada and the northernmost parts of the U.S., following the range of spruce budworm (*Choristoneura fumiferana*). The Project area is at the very edge of its range in Minnesota, although vegetation data from the time of European settlement shows that most of the area was black spruce/balsam fir forest. Bay-breasted warbler populations are closely tied to outbreaks and declines in spruce budworm (Mayasich and Niemie 2002 and references cited therein), and have been decreasing range-wide (4.5% per year in North America between 1986 and 1998). An average of 0.2 bay-breasted warblers have been recorded on the Hart Lake Breeding Bird

Survey route each year since 1966, but none have been recorded on the Jordan Breeding Bird Survey route (Sauer et al. 2012). No bay-breasted warblers were observed on the nearby Tracks Project area. The NRRI's Breeding Bird Monitoring effort has detected bay-breasted warblers in 21 of 169 forest stands, but sightings have been rare. Loss of habitat, change in vegetation composition, management to control spruce budworm, fire suppression, and deforestation in wintering habitat all contribute to the population decline of the bay-breasted warbler.

Bay-breasted warbler breeds primarily in old spruce-fir forests, sometimes pine, and also in spruce bogs and coniferous riparian areas (Maxson 1999). They breed in forests where the conifers are dominant or co-dominant trees. There is little information about their use of black spruce lowlands in Minnesota. They need patches of spruce budworm outbreak over a large area. Birds often move to such an area in large groups. It is possible that maintenance of a viable and well-distributed population may require patches of relatively un-fragmented old spruce-fir forest of more than 3,000 acres capable of hosting a large enough spruce budworm outbreak. Robbins et al. (1989) suggested that some warblers may require extensive areas of interior forest habitat, but research has not been done to find out to determine its applicability to bay-breasted warbler in northeastern Minnesota.

No bay-breasted warblers were seen during wildlife surveys on the federal and non-federal lands, although surveys on Hunting Club Lands, Lake County Lands, and Wolf Lands occurred during late fall after bay-breasted warblers had migrated south for the winter (ENSR 2000, 2005, AECOM 2011a, b, c).

Direct and Indirect Effects

Proposed Action

Bay-breasted warblers favor lowland and upland mature spruce forest. There are about 3,040 acres of mature lowland (MIH 9) and 235 acres of mature upland coniferous forest habitat (MIH 5) on the federal lands that could provide habitat for the bay-breasted warblers. The Project would affect about 482 acres of mature lowland and 24 acres of mature upland coniferous forest habitat (**Table 6**).

There are 1,208 acres of mature lowland coniferous forest and 26 acres of mature upland coniferous forest habitat on the non-federal lands (**Table 6**). These lands would not be directly affected by the Project. Under the Proposed Action, the Forest Service would survey for bay-breasted warblers and associated habitat prior to conducting land-disturbing activities and areas of known or potential habitat would be avoided when feasible.

Alternative B

Potential direct and indirect effects to bay-breasted warblers from the Project under Alternative B would be similar to those under the Proposed Action. Under Alternative B, there are about 2,063 acres of mature lowland and 186 acres of mature upland coniferous forest habitat on the federal lands (**Table 6**). About 977 fewer acres of mature lowland coniferous forest and 49 fewer acres of mature upland coniferous forest on the federal lands would be transferred to PolyMet from the Forest Service under Alternative B than under the Proposed Action. This area could provide habitat for bay-breasted warblers, although noise and other disturbance associated with mining and use of the Dunka Road and Utility Corridor may discourage use of the area by bay-breasted warblers.

The Forest Service would acquire Hay Lake Lands under Alternative B. No bay-breasted warblers were seen on these lands during wildlife surveys, and observations of bay-breasted warblers are extremely rare in the vicinity

of Hay Lake Lands. There is no mature lowland or upland coniferous forest habitat on Hay Lake Lands (**Table 6**). Thus, there would be limited foraging and nesting habitat for bay-breasted warblers on Hay Lake Lands.

No Action Alternative

There would be no direct or indirect effects to bay-breasted warbler under the No Action Alternative.

Cumulative Effects

The greatest threat to the breeding range of the bay-breasted warbler is the reduction in the area of old-growth black spruce and balsam fir of the boreal forest. Both nesting habitat and food supply (spruce budworm) are at risk when reductions or alterations of these forest types occur. Spraying insecticides to control spruce budworm can have direct toxic effect on this warbler (inhibition of brain acetylcholinesterase activity). Winter habitat degradation and loss is also a threat, as commercial and residential development activity continues to reduce the forested habitats in the tropics (Mayasich and Niemie 2002). Green (1995) stated that coniferous forest-dominated stands have decreased and been replaced by trembling aspen over the past 100 years, indicating that less habitat is available at present compared to 100 years ago. Black spruce-balsam fir forest is currently below 2004 Forest Plan objectives and the Minnesota Forest Resources Council Landscape Committee set a goal to increase black spruce-balsam fir forest in Minnesota (USDA Forest Service 2004a). Forest Service data show that spruce budworm defoliation in the eastern U.S. dropped substantially in 1986 from 5 to 8 million acres per year prior to that to less than 1 million acres per year after 1985. In Minnesota, there were about 70,000 of spruce-budworm defoliation in 1999 compared to a million acres in 1958.

About 482 acres of mature lowland coniferous forest and 24 acres of mature upland coniferous forest habitat that could be used by this species on the federal lands would be directly affected by the Project (**Table 6**). However, there are about 356,000 acres of lowland coniferous forest and about 161,000 acres of upland coniferous forest within the CESA that could now, or in the reasonably foreseeable future, provide habitat for bay-breasted warblers (Emmons and Olivier, Inc. 2006:30, 38). Thus, habitat loss from the Project would have a negligible cumulative effect on bay-breasted warblers in the CESA.

Summary

Project activities associated with the Proposed Action and Alternative B should have no adverse direct, indirect, or cumulative effects on individual bay-breasted warblers, but could have direct, indirect, or cumulative effects on their habitat. Bay-breasted warblers were not seen on the federal lands during wildlife surveys for the FEIS, and are rare in the Superior National Forest, although habitat is present. Timber management and road construction could occur on the federal and non-federal lands in the reasonably foreseeable future, but only a small acreage of federal and non-federal lands would be affected. It is more likely that production of immature and mature lowland habitat, prescribed burnings that leave standing dead trees, and partial cuts on the non-federal lands could occur if these lands are federally administered rather than under private ownership.

Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for bay-breasted warbler. The No Action Alternative would have **no impact** to individuals of bay-breasted warbler.

Mitigation and Recommendations

No mitigation measures are recommended for bay-breasted warbler.

5.2.6.8 Connecticut Warbler (*Oporornis agilis*)

Environmental Baseline

The Connecticut warbler has the most restricted breeding distribution of any northern warbler, aside from the Kirtland's warbler, ranging from eastern British Columbia east across south-central Canada to Quebec and south to northern Minnesota, Wisconsin, and the Upper Peninsula and northern Lower Peninsula of Michigan. Eighty-five percent of the North American breeding range of the Connecticut warbler is in Canada (Kudell-Ekstrum 2002 and references cited therein).

The bird is very secretive and difficult to detect. Breeding Bird Survey data showed a 5% per year population decline between 1986 and 1998 in North America. The NRRI's Breeding Bird Monitoring effort detected Connecticut warblers in 41 of 169 forest stands on the Superior National Forest during 1991 through 2005. An average of 0.3 Connecticut warblers have been recorded on the Hart Lake, and two Connecticut warblers on the Jordan Breeding Bird Survey routes each year since 1966 (Sauer et al. 2012). Two Connecticut warblers were seen on the nearby Tracks Project area.

Typical habitat consists of wet areas with black spruce, tamarack, mosses, speckled alder, dogwood, Labrador tea, bog rosemary, bog laurel, and leatherleaf. Breeding habitat consists of black spruce-tamarack bogs, muskeg, poplar woodlands and moist deciduous forests, and jack pine. The Connecticut warbler has been found in 15 forest types in the U.S. consisting of jack pine, red pine, black spruce, mixed swamp conifer, northern white cedar, sugar maple/basswood, tamarack, paper birch, and trembling aspen, and wetland bog and wetland sedge meadow. They may also be found in jack pine with a dense blueberry understory. They forage on the ground and in low shrubs. Boreal bogs that are 100 acres or larger are typical habitat in northeastern Minnesota. Territories of a breeding pair of birds are about 1.2 acres. Connecticut warblers nest on the ground in a small hollow, on moss mound in a bog, or in grasses or weeds, or at the base of a shrub and sometimes forming loose "colonies."

No Connecticut warblers were seen during wildlife surveys of the federal and non-federal lands, although surveys on the Hunting Club, Lake County, and Wolf Lands occurred during late fall after Connecticut warblers had migrated south for the winter (ENSR 2000, 2005, AECOM 2011a, b, c).

Direct and Indirect Effects

Proposed Action

Connecticut warblers favor lowland spruce forest and upland jack pine forest. There are about 3,060 acres of lowland (MIH 9) and 1,252 acres of upland coniferous (MIH 5) forest on the federal lands that could provide habitat for the Connecticut warbler. Approximately 482 acres of lowland coniferous forest and 505 acres of upland coniferous forest habitat would be lost due to mining (**Table 6**). Forest Service MIH mapping did not specifically identify jack pine forest (MIH 8) on the Mine Site, but it is present on the eastern portion of the Mine Site in association with black spruce and trembling aspen.

There are about 3,309 acres of lowland coniferous and 80 acres of upland coniferous forest habitat on the non-federal lands (**Table 6**). These lands would not be directly affected by the Project. Under the Proposed Action, the Forest Service would survey for Connecticut and associated habitat prior to conducting land-disturbing activities and areas of known or potential habitat would be avoided when feasible.

Alternative B

Potential direct and indirect effects to Connecticut warblers from the Project would be similar to those under the Proposed Action. Under Alternative B, there are about 2,079 acres of lowland and 1,139 acres of upland coniferous forest on the federal lands (**Table 6**). About 981 fewer acres of lowland coniferous forest and 113 fewer acres of upland coniferous forest would be transferred to PolyMet from the Forest Service than under the Proposed Action. This area could provide habitat for Connecticut warblers, although noise and other disturbance associated with mining may discourage use of the area by Connecticut warblers.

The Forest Service would acquire Hay Lake Lands under Alternative B. No Connecticut warblers were seen on these lands during wildlife surveys (AECOM 2011b, c), although two Connecticut warblers were observed on the nearby Tracks Project area. There are about 1,818 acres of lowland and 54 acres of upland coniferous forest habitat on Hay Lake Lands (**Table 6**). About 55% of the lowland coniferous forest and 68% of upland coniferous forest that occurs on the non-federal is found on Hay Lake Lands. There would be suitable foraging and nesting habitat for Connecticut warblers on Hay Lake Lands. This habitat should benefit from Forest Service management that favors longer harvest rotations than typically occurs on private forestlands.

No Action Alternative

There would be no direct or indirect effects to Connecticut warbler under the No Action Alternative.

Cumulative Effects

The Connecticut warbler may be sensitive to habitat fragmentation due to increases in nest predation and parasitism that may accompany decreases in forest interior habitat. Loss and fragmentation of jack pine forests was identified as the biggest threat to Connecticut warbler. However Connecticut warblers have been found in association with open forest habitats. Cowbird parasitism may also be a threat.

Peat mining may pose a threat to Connecticut warbler habitat. Peat mining is a large industry in Canada and has started in the U.S. at Pine Island in Koochiching County, Minnesota. Towers and structures have been reported as specific threats. Three hundred Connecticut warblers were killed in one season from collision with towers in Eau Claire, Wisconsin (Kudell-Ekstrum 2002 and references cited therein). Rieck (1999) stated that wintering habitat in northern South America is declining and breeding habitat may also be in decline range-wide.

About 482 acres of lowland coniferous forest and 505 acres of upland coniferous forest habitat that could be used by this species on the federal lands would be directly affected by the Project (**Table 6**). However, there are about 356,000 acres of lowland coniferous forest and 161,000 acres of upland coniferous forest within the CESA that could now, or in the reasonably foreseeable future, provide habitat for Connecticut warblers (Emmons and Olivier, Inc. 2006:30, 38). Thus, habitat loss from the Project would have a negligible cumulative effect on Connecticut warblers in the CESA. Noise and other disturbance from the Project could also cumulatively affect Connecticut warblers, although Connecticut warbler use of the Project area is likely very rare.

Summary

Project activities associated with the Proposed Action and Alternative B should have no adverse direct, indirect, or cumulative effects on individual Connecticut warblers, but could have direct, indirect, or cumulative effects on their habitat. Connecticut warblers have not been seen on the federal lands, and are rare in the Superior National Forest. Timber management and road construction could occur on the federal and non-federal lands in the reasonably foreseeable future, but only a small acreage of federal and non-federal lands would be affected. It is more likely that production of immature and mature lowland habitat and partial cuts that benefit Connecticut warbler would occur on the non-federal lands if these lands are federally administered rather than under private ownership.

Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for Connecticut warbler. The No Action Alternative would have **no impact** to individuals of Connecticut warbler.

Mitigation and Recommendations

No mitigation measures are recommended for Connecticut warbler.

5.2.7 Mammals

5.2.7.1 Eastern Heather Vole (*Phenacomys ungava*)

Environmental Baseline

In eastern North America, the range of the eastern heather vole reaches its southernmost point in the Upper Midwest on the Superior National Forest. A long-term (1995-2006) study of small mammal populations documented 64 eastern heather voles on the Superior National Forest (Jannett 2006 *cited* in USDA Forest Service 2010b).

Eastern heather voles are found in a wide variety of habitats, including coniferous forests and forest borders, heath shrublands, willow thickets, rocky hillsides, and moist meadows (Coffin and Pfannmuller 1988, McAllister and Hofmann 1988). *Vaccinium* species (ericaceous shrubs) are often present where eastern heather voles are found. Naylor et al. (1985) found high densities of eastern heather voles in Ontario in jack pine monocultures with a dense, relatively continuous understory of ericaceous shrubs. Eastern heather voles' preferred habitat appears to be upland forests and openings with ericaceous ground cover not far from water. Anything that encourages grasses encourages meadow voles, which are detrimental to the eastern heather vole.

No eastern heather voles were seen during wildlife surveys of the federal and non-federal lands (ENSR 2000, 2005, AECOM 2011a, b, c). The MDNR NHIS database documents the nearest known eastern heather vole location as 24 miles north of the Project area off of the Tomahawk Road. No eastern heather voles were found on the nearby Tracks Project area.

Direct and Indirect Effects

Proposed Action

Forest Service MIH 8, which is primarily mature jack pine forest, is considered indicative of eastern heather vole habitat. Forest Service MIH mapping did not specifically identify jack pine forest on the federal lands, but jack pine forest is on present across the Mine Site, especially on the eastern portions of the site, and often in association with black spruce and trembling aspen (ENSR 2000, 2005, AECOM 2011a). However, there is no mature jack pine habitat on the Mine Site. There are about 1,252 acres of upland coniferous forest (MIH 5) on the federal lands, including about 235 acres of mature upland coniferous forest that could be used as habitat by the eastern heather vole (**Table 6**). The Project would affect about 505 acres of upland coniferous forest habitat.

The eastern heather vole was not identified on the non-federal lands during wildlife surveys or in the MDNR NHIS database (MDNR 2006, AECOM 2011b, c). There are about 80 acres of upland coniferous forest habitat on the non-federal lands, and jack pine is a component in these forests (**Table 6**). There are only 26 acres of mature coniferous forest habitat found on the non-federal lands. The majority of mature coniferous forest habitat, which consists primarily of eastern white pine, is found on Hunting Club Lands. These lands would not be directly affected by the Project. Under the Proposed Action, the Forest Service would survey for eastern heather vole and associated habitat prior to conducting land-disturbing activities and areas of known or potential habitat would be avoided when feasible.

Alternative B

Potential direct and indirect effects to eastern heather voles from the Project would be similar to those under the Proposed Action. Under Alternative B, there are about 1,252 acres of upland coniferous forest on the federal lands (**Table 6**). About 113 fewer acres of upland coniferous forest on the federal lands would be transferred to PolyMet from the Forest Service under Alternative B than under the Proposed Action. This area could provide habitat for eastern heather vole.

The Forest Service would acquire Hay Lake Lands under Alternative B. No eastern heather voles were seen on these lands during wildlife surveys (AECOM 2011b). Coniferous forest is rare on Hay Lake Lands. There are about 54 acres of upland coniferous forest habitat on Hay Lake Lands, although none of this habitat contains mature forest (**Table 6**). About 68% of the upland coniferous forest that occurs on the non-federal lands is found on Hay Lake Lands. Forest cover was 60 to 70% and was comprised of red pine and jack pine (AECOM 2011b). There would be little suitable habitat for eastern heather vole on Hay Lake Lands, but upland coniferous forest habitat should benefit from Forest Service management that favors longer harvest rotations than typically occurs on private forestlands.

No Action Alternative

There would be no direct or indirect effects to eastern heather vole under the No Action Alternative.

Cumulative Effects

The biggest negative effect to eastern heather vole habitat has likely come from fire suppression. Timber harvest potentially perpetuates habitat for this species, however, an increase of trembling aspen and a decrease of jack pine has likely reduced the amount of suitable habitat for the species. Based on analysis done for the Tracks

Project, the amount of mature jack pine forest should increase in the Superior National Forest during the next 10 years and would benefit eastern heather vole. The Superior National Forest goals are to increase the amount of jack pine forest over time. The cumulative effects analysis for the 2004 Forest Plan BE concluded that habitat conditions in the future are predicted to continue to provide a patchy distribution for eastern heather vole (USDA Forest Service 2004d).

About 505 acres of upland coniferous forest habitat that could be used by this species on the federal lands would be directly affected by the Project, but none of this habitat consists of mature coniferous trees (**Table 6**). There are about 161,000 acres of upland coniferous forest within the CESA that could now, or in the reasonably foreseeable future, provide habitat for eastern heather vole (Emmons and Olivier, Inc. 2006:30, 38). Thus, habitat loss from the Project would have a negligible cumulative effect on eastern heather vole in the CESA. In addition, about 397 acres of the 1,719-acre mine disturbance area would be reclaimed and could become upland coniferous forest habitat 20 years or more after reclamation (MDNR et al. 2013).

Summary

Project activities associated with the Proposed Action and Alternative B should have no adverse direct, indirect, or cumulative effects on individual eastern heather vole, but could have cumulative effects on their habitat. Eastern heather vole has not been seen on the federal lands, and is rare in the Superior National Forest, although habitat is present. Timber management and road construction could occur on the lands in the reasonably foreseeable future, but only a small acreage of federal and non-federal lands would be affected.

Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for eastern heather vole. The No Action Alternative would have **no impact** to individuals of eastern heather vole.

Mitigation and Recommendations

No mitigation measures are recommended for eastern heather vole.

5.2.7.2 Northern Long-eared Bat (*Myotis septentrionalis*), Tri-colored Bat (*Perimyotis subflavus*), and Little Brown Myotis (*Myotis lucifugus*)

Environmental Baseline

The northern long-eared bat, tri-colored bat (synonym: eastern pipistrelle), and little brown myotis bat species were added to the 2011 RFSS list due to the spread of white-nose syndrome, which is a fungal disease affecting bats. In addition, the northern long-eared bat was recently listed by the USFWS as threatened species under the ESA (USDOI USFWS 2013, USACE, and USDA Forest Service 2013). The disease carries a high mortality rate for all bat species, and the Superior National Forest is closely watching the RFSS bat species to identify signs of white-nose syndrome. White-nosed syndrome has been reported at the Tower/Soudan Underground Mine State Park in St. Louis County, 15 miles northwest of the Project area, and in Fillmore County in southeastern Minnesota (USDOI USFWS 2013, U.S. Geological Survey National Wildlife Health Center 2013).

The northern long-eared bat prefers forests and riparian areas. It may hibernate in caves, mines, overhangs, crevices, drill holes, and similar sites. As noted in Section 1.1, the *NorthMet Mining Project and Land Exchange Biological Assessment Draft* was prepared to evaluate project effects to northern long-eared bat, a RFSS species that was recently listed as a federally threatened species (USACE and USDA Forest Service 2013). Additional information on the northern long-eared bat is available in the BA.

The tri-colored bat prefers open areas with large trees and woodland edges. It avoids open fields and deep woods. It may hibernate in caves and mines and roosts in trees and man-made structures. The little brown myotis is the most abundant bat in Minnesota. It is a habitat generalist and its preferred habitat includes boreal forests, bogs and fens, open fields, shrublands, and urban areas. It may hibernate in caves, tunnels, and abandoned mines and roosts in trees and man-made structures. Both the tri-colored bat and the little brown bat generally avoid large open areas, but do forage over or near water and prefer aquatic, soft-bodied insects (e.g., moths, flies, beetles, gnats, mosquitos).

Between 2008 and 2010, acoustic surveys for bats were conducted as part of wildlife surveys for the federal and non-federal lands (AECOM 2011a, b, c). No effort was made to determine the species of bat making the echolocation. Along with the three RFSS bats, four other bat species could occur in the Project area: the big brown bat, the silver-haired bat, the eastern red bat, and the hoary bat. Echolocations recorded during the surveys could have come from any of these seven bat species.

Echolocation surveys were conducted at five stations on the federal lands, although only four stations gave usable information due to rainfall during the survey at one station. Recordings indicated the presence of bats at all sites, with the greatest number of echolocations occurring at open water sites associated with the Partridge River and an unnamed creek, and the fewest echolocations at emergent wetlands covered with water and some aquatic vegetation.

Recordings on Hay Lake Lands showed that most echolocations occurred at an emergent wetland with open water (814 echolocations, mostly feeding activity). Moderate numbers of echolocations were recorded at the two sites along the Pike River (164 echolocations at the north Pike River site, 230 echolocations at the middle Pike River site; feeding activity was moderate), and at two small emergent wetland ponds with limited open water (64 and 181 echolocations; AECOM 2011b). An echolocation site to the south of Hay Lake Lands was located at a small patch of open water associated with an old beaver pond; 72 echolocations were recorded at this site. No echolocation surveys were made on Hunting Club Lands, Lake County Lands, and Wolf Lands as surveys were conducted in November and bats would have already migrated from the area. Surveys were also not conducted at McFarland Lake Lands, although bats likely forage over McFarland Lake.

In the summer of 2013, Superior National Forest staff initiated a pilot project to document forest bat occupancy and collect demographic and habitat data (Grandmaison et al. 2013). Across eight locations on the Kawishiwi District, 34 bats were collected over nine nights. Northern long-eared bats comprised 38% of the captured bats, while little brown bats comprised 62% of the captured bats. No tri-colored bats were documented in the survey (Grandmaison et al. 2013).

In the spring of 2014, the Superior National Forest staff and MDNR staff, with additional funding from USFWS, conducted a pilot project to describe summer habitat use by northern long-eared bats in Minnesota. Surveys were conducted at 12 sites, five of which were on the Superior National Forest. The survey captured six of the seven species of bats known to occur in Minnesota; tri-colored bat was the only species not captured. The most

ANALYSIS AND DETERMINATION OF EFFECTS

frequently captured bats were little brown bats (45%) and northern long-eared bats (22%) (USDA Forest Service 2014b).

Superior National Forest staff conducted surveys for the northern long-eared bat and the little brown bat at three general locations in the Project area in July and August 2014 (USDA Forest Service 2014a; Personal Communication, Dan Ryan, USDA Forest Service, January 9, 2015). The three Project locations included the Mine Site, the Plant Site, and the Dunka Road and Utility Corridor. Survey methods utilized passive sonic (Anabat) detectors on the Mine Site and transportation corridor. At the Plant Site, the methods were primarily direct observation of bat species, supplemented by passive sonic detectors when feasible. The surveys found northern long-eared bats, little brown bats, silver-haired bats, big brown bats, hoary bats and eastern red bats present at the Mine Site with little brown bat accounting for 78% of all calls and northern long-eared bat accounting for 14% of all calls (USDA Forest Service 2014a). The eastern red bat was the only species whose calls were not identified during the driving surveys. Emergence surveys at the Plant Site in conjunction with the sonic detectors identified the presence of little brown bat, northern long-eared bat, silver-haired bat and big brown bat. The tri-color bat was not detected in any of the surveys (USDA Forest Service 2014a). The 2014 surveys suggested that the Mine Site may contain roost sites, however, there have been no surveys specifically targeted for identification of roost sites.

Bats were seen during wildlife surveys of the federal and non-federal lands, but were not identified to species. As noted above, bats foraged and drank water on wetlands and other aquatic habitats with some open water. There are no caves or mine shafts that could be used for hibernation on the federal lands, but bats could also roost in tree hollows and under tree bark, or under railroad trestles near the Mine Site. Bats have occasionally been observed in Plant Site buildings, but do not hibernate or roost in great numbers at the Plant Site.

Direct and Indirect Effects

Proposed Action

There are about 210 acres of open bog, 31 acres of open water, 36 acres of sedge/wet meadow, and 97 acres of shallow marsh habitat that could be used by bats for feeding and drinking on the federal lands (**Table 8**). There are about 4,312 acres of lowland and upland coniferous forest habitat (MIH 5 and 9) that could be used by bats for roosting on the federal lands (**Table 6**). The Project would directly affect 65 acres of open bog, open water, sedge/wet meadow, and shallow marsh habitat and 987 acres of lowland and upland coniferous forest habitat (**Tables 6 and 8**).

Potential indirect affects to the tri-color and little brown bat from drinking water from Project ponds and from the consumption of insects that may inhabit or drink from the ponds is qualitatively assessed. MnDNR (2015) identifies that the tri-color bat is typically found in the southeast corner of the state and the occurrence in the northeast portion of the state is considered rare. Even though the tri-color bat was not detected in the 2014 Forest Service surveys, it is assumed to have the potential to be present in the Project area. A qualitative assessment of potential affects to the northern long-eared bat is provided in the Biological Assessment Report.

The tri-color bat and the little brown bat are considered habitat generalists by some researchers (Ford et al. 2005). Studies have identified the little brown bat to have a preference for foraging along the forest edge (Broders et al. 2006; Jantzen 2012). Both the tri-color and little brown bat have an affinity for water and feed above open water (Fenton and Barclay 1980; Broders et al. 2006; Lookingbill et al. 2010), and using water sources within the forest for drinking (woodland seasonal pools and beaver ponds) (Francel 2008). Other studies identify that the little brown bat has some affinity for open upland areas (meadow, prairie, and savanna) (Buckman-Sewald et al. 2014). Jantzen (2012) found bat activity (little brown bat, northern long-eared bat) to be concentrated within about 40 meters of the forest/open edge and Fulton et al. (2014) found that bats were more active in hydric habitats (riparian areas and wetlands) than in the surrounding forest. Lookingbill et al. (2010) identified a foraging radius of 500 meters for the little brown bat and 100 meters for the tri-color bat. Tri-colored bats tend to avoid deep woods or open fields (Ford et al. 2005). The Wisconsin DNR (2013) identified that little brown bats would preferentially follow a forest edge rather than fly across a large open area such as a field. Common summer roosting habitat is in older forest stands that provide more opportunities for roosting in cavities, but because they are common to a wide range of areas they also roost in human-made structures (Wisconsin DNR 2013).

In comparison, the northern long-eared bat is a forest specialist (Henderson and Broders 2008; Chapman et al. 2014). As a forest specialist, the weight of evidence in the literature (Henderson and Broders 2008; Jantzen 2012; Chapman et al. 2014) indicates it would be highly unlikely for the northern long-eared bat to be present in the large open area at the future Mine Site or near the ponds within the Plant Site.

About 57% of the 3,015 acre Mine Site would be affected by the Project. Much of this affected area would be cleared of vegetation to accommodate the mine pits and associated infrastructure (e.g., haul roads, stockpile, stormwater ponds, waste water ponds) and would become a large open area during operations. The existing Plant Site is primarily an open area dominated by the LTVSMC Tailings Basin and would continue as an open area during Project operations. Overall, the peer-reviewed literature identifies that bats will forage at those locations where insect density is highest (Jantzen 2012; Lookingbill et al. 2010) and the large area of existing wetlands around the Tailings Basin and the future Mine Site would likely attract a large portion of the

local population of bats. Further, Francl (2008) has identified the little brown bat's predominance at woodland seasonal pools. Based on the peer-reviewed literature and the existing wetland and riparian areas immediately adjacent to the Mine Site, there is a low probability that either species would use the operational Mine Site to any great extent. However, because both species of bat are known to feed over open water and because the 2014 Forest Service bat surveys identified the little brown bat presence within the existing Tailings Basin (Forest Service 2014a: Figure 4), it is possible that some number of bats may be present within the active Flotation Tailings Basin during mining operations although it is uncertain if bats would use an active tailings basin in the same manner or frequency that they currently use the reclaimed LTVSMC Tailings Basin.

The Project's water management is expected to limit the potential exposure of bats to indirect effects from the various water features at the Plant Site or Mine Site and consumption of insects that may use these water features. Project water features include stormwater ponds, process water ponds, water in active mine pits, constructed wetlands, the Hydrometallurgical Facility pond (operations), the Flotation Tailings Basin Pond and wetland (reclamation and long-term closure), and the West Pit lake (long-term closure). Each water feature is qualitatively evaluated for potential indirect effects to bats.

1. Stormwater from precipitation and runoff would be directed to sedimentation ponds to remove total suspended solids prior to being discharged off-site. Water in the ponds prior to discharge is expected to reflect background concentrations of water quality parameters (including metals and mercury) and any aquatic insects inhabiting stormwater ponds should have metal and mercury concentrations that reflect background conditions, and therefore, similar to existing conditions. Therefore, any consumers of aquatic insects (including bats) from Project stormwater ponds should not be exposed to metal or mercury concentrations in those insects above background levels.
2. Process water would be collected and stored in a number of ponds at the Mine Site (e.g., Overburden Storage and Laydown Area Pond) and the Flotation Tailings Basin Pond and Hydrometallurgical Residue Facility Pond at the Plant Site and be actively managed for re-use. The probability of insects inhabiting or using a process water pond as a source of drinking water is expected to be low because: 1) these ponds would tend to be turbid and limit the establishment and growth of plants and in turn limit organic materials and the establishment of macroinvertebrates (Nelms et al. 2012); 2) mining-related water is low in organic carbon (Berndt and Bavin 2012) and nutrients and would limit growth and reproduction of algae, macroinvertebrates, and other biota (Nelms et al. 2012; Seger et al. 2012); 3) the use of liners and/or compacted bottoms to maximize water retention would not likely provide a suitable substrate for the larval stages of most aquatic insects (Flake and Cieminski 1996); and 4) fine mineral sediments that have little silt or clay are poor media for plant establishment and growth (Nelms et al. 2012) and further limits the presence of aquatic insects that require organic materials for food (Seger et al. 2012). The above listed factors likely limit the aquatic life in process water ponds. Insects from Project process water ponds would likely represent a very small percent of the diet of consumers of aquatic insects when compared to the large acreage of existing wetlands around the Plant Site and Mine Site that currently provide the forage base for bats and other consumers. Overall, limited pond productivity likely reduces the potential effect of process water ponds on insects and consumers of those insects such as bat species.

Similar to taconite processing, mercury in process water sent to the Flotation Tailings Basin Pond

and the Hydrometallurgical Residue Facility Pond is expected to be associated with the solids and sequestered with those solids in the respective ponds and result in relatively low concentrations of mercury in the water column (Barr 2007b; PolyMet 2015). Mercury associated with solids such as tailings is sequestered within the basin and is typically not released from the basin (Berndt 2003) and not readily bioavailable. The continual deposition of solids in these ponds is likely to limit sediment-dwelling organisms (Nelms et al. 2012), as would the lack of organic material for food (Flake and Cieminski 1996; Nelms et al. 2012). Limited pond productivity and sequestration of mercury with solids likely reduces the potential effect of process water ponds on bat species.

3. Mine pit dewatering would occur during Mine Years 1 through 20 and this process water would be routed to the Waste Water Treatment Facility for initial treatment and then pumped to the Flotation Tailing Basin Pond for use in ore processing (Poly Met 2014c). A minimal amount of water is expected to be present in an active mine pit, therefore the probability of aquatic insects inhabiting or using a sump area is low. The continual removal of water is likely to limit the presence of aquatic organisms (Nelms et al. 2012), as would the lack of organic material for food (Flake and Cieminski 1996; Nelms et al. 2012). Limited productivity reduces the potential effect of mine pit watering on bat species, including the northern long-eared bat which is a forest specialist (Henderson and Broders 2008; Jantzen 2012; Chapman et al. 2014) and not expected to be present within the mine pits.
4. As part of reclamation, some stormwater ponds and process water ponds would be filled and converted to terrestrial habitat (.e.g., Hydrometallurgical Residue Facility Pond) (Poly Met 2014b; 2014e; 2014f). Ponds filled and reclaimed to terrestrial vegetation would have the potential to produce runoff water that would be expected to reflect background conditions. Reclaiming ponds to terrestrial vegetation is not expected to produce runoff that would adversely affect aquatic insects.

A part of the East Pit (after backfilling is completed) and some stormwater and process water ponds would be converted to wetlands (Poly Met 2014b, 2014c, 2014d). These constructed wetlands are expected to receive precipitation and stormwater runoff. The accumulating water should reflect background concentrations for various parameters (including mercury). Any aquatic insects inhabiting a constructed wetland or using it as a source of drinking water should have metal or mercury concentrations that reflect background conditions. Therefore, any consumers of these aquatic insects (including bats) should not be exposed to metal or mercury concentrations in those insects above background levels.

In regard to the backfilling of the East Pit, the water level would be maintained below the level of the fill material to facilitate truck hauling (Poly Met 2014b). No visible ponding of water is expected during backfilling. Therefore, backfilling of the East Pit would have no potential to affect aquatic organisms.

5. The Flotation Tailings Basin Pond would be present after Mine Year 20 and a wetland would be constructed around the perimeter of the pond. The pond and wetland are expected to be present into long-term closure. After Mine Year 20, the Beneficiation Plant and Mine Site would no longer contribute water and the largest source of water to the pond would be precipitation and

runoff (Poly Met 2015). In long-term closure, the water in the pond would be primarily from precipitation and runoff (Poly Met 2015) and would be expected to reflect background conditions and parameter concentrations (including mercury). Any aquatic insects inhabiting the Flotation Tailings Basin Pond or using it as a source of drinking water during long-term closure should have metal or mercury concentrations that reflect background conditions. Therefore, any consumers of these aquatic insects (including bats) should not be exposed to metal or mercury concentrations in those insects above background levels.

6. The depth of the West Pit at the end of mining will be more than 600 feet. Flooding of the pit would result in rapid water level increases that are predicted to average about 17 feet per year (Poly Met 2014g). Rapidly rising water levels likely limits the aquatic life that would inhabit the lake during the years of pit flooding (Nelms et al. 2007). Therefore, the potential exposure of bats to any insects that might inhabit or use the West Pit lake during the early years of flooding is likely low.

The majority of water used to flood the West Pit would be primarily from precipitation and stormwater runoff (Poly Met 2014g) and as the pit fills the parameter concentrations in the upper portion of the water column (i.e., the epilimnion) should reflect background (including mercury). Flooding of the West Pit would produce a pit lake that is approximately 320 acres in size with a maximum depth of 630 feet (Poly Met 2014b). As an oligotrophic system with a small littoral area, aquatic insect diversity and numbers in the West Pit lake would be limited (Nelms et al. 2012; Gray et al. 2012). Data for pit lakes identifies they have low densities and diversity of invertebrates (MDNR 1989). In addition, pit lake waters are typically low in phosphorus, limiting primary production (MDNR 1989). For the above reasons, overall, the potential population of aquatic insects in the West Pit lake is expected to be small. In addition, these insects would likely represent only a small portion of the diet of consumers of aquatic insects. Therefore aquatic insects inhabiting the West Pit lake or using it as a source of drinking water would likely have no significant effect on insect consumers such as bats.

With regard to mercury, the West Pit lake is estimated to have a total mercury concentration of 0.3 to 0.9 ng/L during flooding and in long-term closure (Poly Met, 2014g). Because precipitation would be the main input of water to the West Pit lake, metal concentrations in long-term closure would likely reflect background conditions. Therefore, any aquatic insects inhabiting the West Pit lake or drinking from the West Pit lake would be exposed to background concentrations. Any consumers of these aquatic insects (including bats) should not be exposed to mercury concentrations in those insects above background levels.

Because existing wetlands at the Plant Site (e.g., north of the tailings basin) and the Mine Site (e.g., 100 Mile Swamp) would be providing an abundant supply of insects, the majority of bats and other consumers of insects would likely be focused in these areas and would not likely be relying solely on the Project water features for their food supply. Therefore, any insects inhabiting Project water features or using them as sources of drinking water are not expected to have a significant effect on the consumers of insects. Overall, the Project's water features are not expected to have adverse indirect effects on bats. Project noise would potentially have an impact on bat utilization of maternity and roosting habitat in the vicinity of the Mine Site. Existing ambient steady equivalent noise levels for most of the Mine Site are in the range of 35 to 45 decibels (dBA), which is a range comparable to secluded woods or a quiet bedroom (MPCA 1999). The Peter Mitchell Mine, north of the Mine

Site, and traffic along Dunka Road and the existing railway, along the south edge of the Mine Site, also contribute brief, episodic noise impacts.

The primary sources of Project noise from the Mine Site would be blasting, haul trucks, and train horns, with noise levels ranging from 89-115 dBA. Equipment such as graders, bull dozers, and support trucks would be less dominant sources of noise, ranging from 75-95 dBA (EPA 1971). Blasting at the Mine Site is expected to occur once every two to three days. Typically, rock blasting generates a single event noise level ranging from 111- 115 dBA at 50 feet from the blasting site (Table 5.5-7 of Madera County 2005). Within most of the Mine Site, the sound from the blast would be similar to a loud clap of thunder.

Bats were seen on the non-federal lands during wildlife surveys (AECOM 2011b, c). There are about 7 acres of open bog, 183 acres of open water, 0 acres of sedge/wet meadow, and 117 acres of shallow marsh on the non-federal lands (**Table 8**). There are about 3,389 acres of lowland and upland coniferous forest habitat (MIH 5 and 9) that could be used by bats for roosting on the non-federal lands (**Table 6**). These lands would not be directly affected by the Project. Under the Proposed Action, the Forest Service would survey for bats and associated habitat prior to conducting land-disturbing activities and areas of known or potential habitat would be avoided when feasible.

Alternative B

Potential direct and indirect effects to bats from the Project would be similar to those under the Proposed Action. Under Alternative B, there are 175 acres of open bog, 9 acres of open water, 35 acres of sedge/wet meadow, 81 acres of shallow marsh, and 3,218 acres of lowland and upland coniferous forest on the federal lands (**Tables 6 and 8**). About 74 fewer acres of open bog, open water, sedge/wet meadow, and shallow marsh habitat and 1,094 fewer acres of lowland and upland coniferous forest habitat on the federal lands would be transferred to PolyMet from the Forest Service under Alternative B than under the Proposed Action. This habitat could be used by bats. Habitat loss to mining activities would be the same as under the Proposed Action.

The Forest Service would acquire Hay Lake Lands under Alternative B. Bats were seen at several locations on the lands during wildlife surveys (AECOM 2011b). There are 2 acres of open bog, 177 acres of open water, 0 acres of sedge/wet meadow, 84 acres of shallow marsh, and 1,872 acres of lowland and upland coniferous forest (MIH 5 and 9) on Hay Lake Lands (AECOM 2011b). About 86% of the open bog, open water, sedge/wet meadow, and shallow marsh and 55% of the lowland and upland coniferous forest (MIH 5 and 9) that occurs on the non-federal lands is found on Hay Lake Lands (**Tables 6 and 8**). This habitat would benefit from Forest Service management that favors longer protection of wetlands and other aquatic resources.

No Action Alternative

There would be no direct or indirect effects to northern long-eared bat, tri-colored bat, or little brown myotis bat under the No Action Alternative.

Cumulative Effects

Bats are facing loss of habitat from fewer old houses, buildings, old open mines, and snags (dead and decaying trees). Loggers cut down snags because they can be a danger, and people target snags for firewood. However, protecting old open mines that provide habitat for bats, limiting human intrusion into these mines with bat gates,

and managing forests to protect snags has helped to slow the loss of bat hibernacula (hibernation) and roosting habitat.

As noted above, the Forest Service has added the northern long-eared bat, tri-colored bat, and little brown myotis to the RFSS list due to concerns about white-nosed syndrome. White-nose syndrome has killed more than a million bats in the northeastern U.S. A fungus that thrives in the same cold temperature range as hibernating bats causes a white fuzzy growth on their noses and wings. Scientists speculate the fungus interrupts sleep patterns and causes the hibernating bats to awaken, depleting their fat reserves and causing starvation.

Bats also have been found dead near wind energy towers. Most collision mortality involves migrating or dispersing bats, not resident, breeding bats (MDNR 2008). Future research should concentrate on determining the cause of bat collisions with wind turbines and methods to reduce and mitigate the mortality.

About 65 acres of wetland/aquatic habitat and 987 acres of lowland and upland coniferous habitat that could be used by bats on the federal lands would be directly affected by the Project (**Tables 6 and 8**). However, there are about 67,000 acres of open wetland and open wetland, and about 517,000 acres of lowland and upland coniferous forest habitat within the CESA that could now, or in the reasonably foreseeable future, provide habitat for northern long-eared bat, tri-colored bat, and little brown myotis (Emmons and Olivier, Inc. 2006:30, 38). Thus, habitat loss from the Project would have a negligible cumulative effect on northern long-eared bat, tri-colored bat, and little brown myotis in the CESA. In addition, about 516 acres that would be affected by mining would be reclaimed to wetland and open water habitat (MDNR et al. 2013). Reclaimed areas would likely provide feeding and drinking habitat for bats soon after reclamation, and could provide roosting habitat about 80 or more years after trees establish on the reclamation areas (USDA Forest Service 2004a). In addition, about 614 acres of mining disturbance would be reclaimed to grassland/herbaceous habitat and could provide roosting habitat about 80 or more years after trees establish on these reclamation sites (MDNR et al. 2013).

Summary

Project activities associated with the Proposed Action and Alternative B could have adverse direct, indirect, or cumulative effects on individual northern long-eared bat, tri-colored bat, and little brown myotis and their habitats. Bats are common on the federal and non-federal lands. About 65 acres of open bog, open water, sedge/wet meadow, and shallow marsh habitat that could be used by bats for foraging and drinking would be lost due to mining (**Table 8**). In addition, about 987 acres of lowland and upland coniferous forest habitat that could be used by bats for roosting would be lost due to mining (**Table 6**).

Timber management and road construction could occur on the federal and non-federal lands in the reasonably foreseeable future and could destroy bat habitat, but only a small acreage of federal and non-federal lands would be affected. It is more likely that production of immature and mature upland coniferous habitat that benefits roosting bats would occur on the non-federal lands if these lands are federally administered rather than under private ownership. PolyMet would follow the April 2015 interim 4(d) rules for the federally-threatened northern long-eared bat regarding tree removal (USFWS 2015), or would consult with the USFWS if tree removal activities do not meet the criteria of the exempted activities presented in the interim 4(d) rules. Wetland and other aquatic habitat would be about equally protected under Forest Service or private ownership because of federal and state laws.

Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for northern long-eared bat, tri-colored bat, and little brown myotis. The No Action Alternative would have **no impact** to individuals of northern long-eared bat, tri-colored bat, and little brown myotis.

Mitigation and Recommendations

No mitigation measures are recommended for northern long-eared bat, tri-colored bat, and little brown myotis.

5.2.7.3 Gray Wolf

As noted in Section 1.1, the *NorthMet Mining Project and Land Exchange Biological Assessment Draft* was prepared to evaluate project effects to gray wolf, a RFSS species that has been federally listed as threatened in the past, delisted in 2011, and relisted December 19, 2014, following a federal court reversal of the USFWS decision to delist the gray wolf. The following summarizes the results of the BA.

Environmental Baseline

The gray wolf is the largest wild member of the dog family (*Canidae*) and is common on and near the federal and non-federal lands. In 1967, the gray wolf was determined to be endangered under the Endangered Species Preservation Act of 1966, in response to their vastly declining numbers range wide. In 1974, the species was formally listed as endangered through the authority of the ESA, and the Minnesota population was reclassified to threatened in 1977. In April 2003, gray wolf populations in the U.S. were separated into three Distinct Population Segments (DPS) to more effectively manage the species; the Minnesota population was a designated portion of the Eastern DPS. In 1978, critical habitat was designated for the Eastern DPS of gray wolf. That rule identified critical habitat at Isle Royale National Park, Michigan, and Minnesota wolf management zones 1, 2, and 3. Wolf management zones 1, 2, and 3 comprised approximately 9,800 mi² in northeastern and north central Minnesota and included all of the Superior National Forest and portions of the Chippewa National Forest. Hunting Club Lands and McFarland Lake Lands were in Zone 1, while the federal lands, and other non-federal lands were in Zone 2.

On December 28, 2011, the USFWS revised the 1978 listing of the Minnesota population of gray wolf to conform to statutory and policy requirements. The USFWS renamed what was previously listed as the Minnesota population of the gray wolf as the Western Great Lakes DPS, and delineated the boundaries of the expanded Minnesota population segment to include all of Minnesota, Wisconsin, and Michigan and portions of the adjacent states. The USFWS removed the Western Great Lakes DPS from the list of endangered and threatened wildlife. The USFWS took this action because the best available scientific and commercial information indicated that the Western Great Lakes DPS does not meet the definitions of threatened or endangered under the ESA. This final rule also removed the designated critical habitat for the gray wolf in Minnesota and Michigan and the special regulations under Section 4(d) of the ESA for gray wolves in Minnesota. In 2012, the MDNR established a regulated hunting and trapping season for wolves in Minnesota. On December 19, 2014, a federal court reversed the USFWS decision to delist the gray wolf, restoring federal threatened status and critical habitat designation in Minnesota.

Six comparable surveys of gray wolf numbers and range in Minnesota have been carried out since 1979. Gray wolf populations in Minnesota were estimated at 1,235 in 1979; 1,500 to 1,750 in 1989; 2,440 in 1998; 3,020 in 2004, and 2,920 in 2008 (Berg and Kuehn 1982, Fuller et al. 1992, Berg and Benson 1999, Erb 2008). The 1998 and later surveys revealed that the number of gray wolves in Minnesota was two times greater than the planning goal (1,400 gray wolves) as specified in the Recovery Plan for Minnesota. However, the 2012 survey showed that gray wolf numbers have declined statewide from 2,920 in 2008 to about 2,200 in 2012 (Erb and Samson 2013).

Gray wolves are carnivorous predators that prefer a diet of medium and large mammals. Prey species in Minnesota include white-tailed deer, moose, beaver, and snowshoe hare, with small mammals, birds, and large invertebrates sometimes being taken (Mech 1974, Wisconsin DNR 1999). Gray wolves are habitat generalists that do not depend on the type, age, or structure of vegetation. Instead, they are indirectly influenced by vegetative condition through the distribution of their primary prey species.

Potential and favorable gray wolf habitat is defined by several elements such as low human population density, sufficient prey density, low road density, vegetation cover, and special landscape patterns (Mladenoff et al. 1995). Gray wolves can live in most any habitat that supports ungulate prey. Gray wolf densities are directly related to the densities of their primary ungulate prey (Fuller 1989). Thus, forested areas occupied by white-tailed deer and moose are important habitat. Additionally, the habitat should be suitable for smaller prey such as beaver and snowshoe hare that may be seasonally important (Mech 1970). Moose, deer, and snowshoe hare tend to forage in areas of regenerating upland forest, and coniferous forest is an important component of thermal cover for all. Riparian trembling aspen forest is important for beavers. Patch structure is only important in that it may alter prey densities or include areas of high road and human densities thereby indirectly altering gray wolf distribution (Fuller 1997).

The Forest Service identified young forest (MIH by age class - young) that is less than 10 years old as providing important foraging habitat for wolves (USDA Forest Service 2004b). Immature and mature forest habitat provides important cover habitat for wolves (MIH by age class - immature and mature).

Gray wolf tracks, scat, and signs of gray wolf kills were seen during wildlife studies on the federal lands, Dunka Road and Utility Corridor, and Plant Site during 2000, 2004, 2008, and 2009 (ENSR 2000, 2005, AECOM 2009, 2011a). Tracks were commonly seen on the Dunka Road, on mine exploration roads, along railroad grades and utility ROW, and north of the Mine Site on Northshore Mine roads during all seasons. In addition, several wolves responded to calls from the Mine Site during 2004. The wolves were located to the south of the calling station, and likely south of the property boundary based on call intensity and direction.

Gray wolf tracks and scat were recorded on the Hay Lake Lands, Wolf Lands 3 and 4, and Lake County Lands North during the survey. Gray wolf scat was seen on several abandoned logging roads. No wolves or their sign were seen on the other non-federal lands, although conditions for surveys were not favorable for detecting tracks and scat at the Hunting Club Lands.

Until 2012, International Wolf Center posted on their website a database summary of gray wolf radiotelemetry observations in northeastern Minnesota. Of the over 11,000 records in the monitoring database between 1994 and 2010, 10 records were for wolves recorded on the federal lands; however, there were no records for the Plant Site or Transportation and Utility Corridors (International Wolf Center 2012). Radiocollared wolves have been recorded on the townships of the Hay Lake Lands. A gray wolf was observed in Section 6 of Township 58

North, Range 16 West in September 1994, just south of Hay Lake. Wolves were observed in Sections 1, 19, 22, and 23 of Township 59 North, Range 16 West, in and around the Hay Lake Lands, between 1994 and 1997. Radiocollared wolves have been recorded in the vicinity of Wolf Lands 2 and 3. There are no recorded observations of wolves in the township of the McFarland Lake Lands, although the McFarland Lake Lands and other non-federal lands that would be involved in the land exchange are within the current range of the gray wolf (Erb and Sampson 2013).

Direct and Indirect Effects

Proposed Action

There are 271 acres of gray wolf foraging habitat and 5,393 acres of gray wolf cover habitat on the federal lands that could be used as habitat by the gray wolf (**Table 6**). The Project would affect about 181 acres of gray wolf foraging habitat and 1,333 acres of gray wolf cover habitat (**Table 6**). Loss of this habitat would reduce the availability of prey and cover for gray wolf traveling through the Project area. Loss of habitat would also make it less likely that a gray wolf pack would establish a territory within the Project area, especially areas directly affected by the Project. The primary effects to gray wolf prey habitat from the Project would result from habitat loss and disturbance.

Project noise would potentially have an impact on gray wolf utilization of habitat in the vicinity of the Mine Site. Existing ambient steady equivalent noise levels for most of the Mine Site are in the range of 35 to 45 decibels (dBA), which is a range comparable to secluded woods or a quiet bedroom (MPCA 1999). The Peter Mitchell Mine, north of the Mine Site, and traffic along Dunka Road and the existing railway, along the south edge of the Mine Site, also contribute brief, episodic noise impacts.

The primary sources of Project noise from the Mine Site would be blasting, haul trucks, and train horns, with noise levels ranging from 89-115 dBA. Equipment such as graders, bull dozers, and support trucks would be less dominant sources of noise, ranging from 75-95 dBA (EPA 1971). Blasting at the Mine Site is expected to occur once every two to three days. Typically, rock blasting generates a single event noise level ranging from 111- 115 dBA at 50 feet from the blasting site (Table 5.5-7 of Madera County 2005). Within most of the Mine Site, the sound from the blast would be similar to a loud clap of thunder.

The impacts of noise on gray wolf utilization of habitat near the Mine Site are largely unknown and the assessment of impacts remains subjective. Impacts may also vary between individual gray wolves. Some may adapt to predictable human activities, so if the activity generally occurs at predictable time periods at the same places or along the same routes, individual gray wolves may become habituated to the activity (ENSR/AECOM 2006).

There are 778 acres of gray wolf foraging habitat and 5,365 acres of gray wolf cover habitat on the non-federal lands (**Table 6**). The Forest Service has not determined the suitability of these lands to provide habitat for wolves or their prey. However, wildlife habitat surveys conducted on these lands give an indication of the suitability of these lands for these species. Portions of the non-federal lands have been harvested for timber during the past 20 years, with much of the harvest occurring on Lake County Lands and Wolf Lands 2 and 3. Under the Proposed Action, the Forest Service would survey for gray wolves and associated habitat prior to conducting land-disturbing activities and areas of known or potential habitat would be avoided when feasible.

Alternative B

Potential direct and indirect effects to wolves from the Project would be similar to those under the Proposed Action. Under Alternative B, there are 271 acres of gray wolf foraging habitat and 3,901 acres of gray wolf cover habitat on the federal lands. The same acreage of gray wolf foraging habitat and 1,492 fewer acres of gray wolf cover habitat would be transferred to PolyMet from the Forest Service under Alternative B than under the Proposed Action.

The Forest Service would acquire Hay Lake Lands under Alternative B. Gray wolf howling surveys were conducted at night on Hay Lake Lands. No gray wolves were heard during howling surveys, but sign of gray wolf was seen on Hay Lake Lands. Gray wolf scat was seen on several abandoned logging roads (AECOM 2011b). There are about 534 acres of gray wolf foraging habitat and 3,720 acres of gray wolf cover habitat on Hay Lake Lands (**Table 6**). About 69% of the gray wolf forage habitat and 69% of the gray wolf cover habitat that occurs on the non-federal lands is found on Hay Lake Lands. Lowland and upland coniferous forest habitat would benefit from Forest Service management that favors longer harvest rotations than typically occurs on private forestlands.

No Action Alternative

There should be no direct or indirect effects to gray wolf under the No Action Alternative.

Cumulative Effects

The Project and other nearby proposed mine projects would increase the amount of habitat fragmentation in the area, changing wooded/forested and other vegetated habitats to disturbed/developed areas with limited habitat value. Development of iron mines along the Iron Range has made portions of this area of limited value to the gray wolf, especially areas with pits, tailings, and waste rock piles. Historic waste rock piles and tailings have begun to revegetate and provide some habitat for gray wolf and their prey.

The Project would increase the amount of human access and disturbance in the area. Increased human populations in the Project area may also lead to increased risk to wolves from collisions with vehicles and trains, increased levels of recreation activities and use of backcountry roads and trails, and increased mortality from illegal hunting and trapping.

Minnesota's Wolf Management Plan will ensure the gray wolf's long-term survival. The plan gives owners of livestock and domestic pets more protection from gray wolf depredation. It splits the state into two management zones with more protective regulations in the northern third, considered the gray wolf's core range. The MDNR has not established a maximum population goal and wolves are allowed to naturally expand their range. A statewide winter population of 1,600 wolves is the minimum goal. If Minnesota's gray wolf population falls below this minimum, the MDNR will take immediate and appropriate management actions to reverse the decline and restore the population to its minimum level in the shortest possible time. The MDNR implemented a conservative and regulated hunting and trapping season in fall 2012. Hunters and trappers harvested 413 wolves in 2012 (MDNR 2013a). The MDNR expects the 2013 season to follow a similar framework with a harvest goal of 220 wolves (MDNR 2013b).

Given that the number of miles of roads associated with the federal and non-federal lands after mining is expected to be similar to or less than current levels, effects associated with road mileage are not expected to accumulate from the Project. The potential for wolves to be killed from vehicle/rail collisions was estimated using the methodology described in Section 6.1.2.1 of the BA (USACE and USDA Forest Service 2013). Assuming that there is about 0.04 gray wolf/km², that vehicle/rail collisions could occur along the 8-mile Transportation and Utility Corridors and railroad, and that vehicles and rail traffic have equal potential for collisions with wolves, it was estimated that approximately 0.05 gray wolf could be killed annually by vehicle/train traffic between the Mine Site and Plant Site, or about one gray wolf during the estimated 20-year life of the Project (assuming that mortalities due to collisions with vehicles and trains were twice the estimated level).

ANALYSIS AND DETERMINATION OF EFFECTS

Using the same assumptions and methodology used to estimate gray wolf mortality on Project roads and railroads (see Section 6.1.2.1 of the BA), approximately 0.3 gray wolf could be killed annually by vehicle/train traffic on off-Project access roads/rail lines to the Plant Site, or about six wolves during the estimated 20-year life of the Project (assuming that mortalities due to collisions with vehicles and trains were twice the estimated level).

Hunting and trapping of wolves would not be allowed on lands administered by PolyMet. Thus, there should be no illegal or accidental take due to the Project. Loss of wolves to illegal trapping and hunting should remain near current levels on the non-federal lands, while the number of wolves harvested on non-federal lands during legal hunting seasons will vary based on gray wolf population levels. Thus, there should be negligible or no cumulative effect to legal, illegal, and accidental take of wolves from the Project and land exchange.

About 181 acres of gray wolf foraging habitat and 1,333 acres of gray wolf cover habitat would be lost due to mining (**Table 6**). Development of the Mine Site would add to habitat fragmentation by eventually converting habitat on the Mine Site to an open water pit lake (321 acres) and waste rock stockpiles (526 acres) of limited value to wolves. The Mine Site would account for about 0.4% of habitat affected by future mining activity within the next 30 years (Barr 2009b).

Although the Project would result in habitat loss and fragmentation on about 1,719 acres for about 20 years (until the Project is reclaimed), in the context of available habitat, and habitat that would be available to wolves in the reasonably foreseeable future, cumulative effects of the Project on habitat loss and fragmentation would be minor.

Summary

Project activities associated with the Proposed Action and Alternative B would have adverse direct, indirect, and cumulative effects on wolves and their habitat. Wolves have been seen on or near the federal and non-federal lands. Timber management and road construction could occur on the federal and non-federal lands in the reasonably foreseeable future and could destroy gray wolf habitat, but only a small acreage of federal and non-federal lands would be affected. It is more likely that production of immature and mature lowland and upland coniferous habitat that benefits gray wolf cover would occur on the non-federal lands if these lands are federally administered rather than under private ownership, although more gray wolf foraging habitat could be created on the non-federal lands under private ownership.

Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for gray wolves. The No Action Alternative would have **no impact** to individual gray wolves.

Mitigation and Recommendations

Mitigation measures recommended for gray wolf would be primarily designed to reduce the likelihood of vehicle collisions with wolves by increasing visibility and improving wolf identification by employees. These include:

1. Reduce speed limits on Dunka Road and on haul roads.

2. Clear trees and shrubs along the inside of curves in Dunka Road to increase sight distance.
3. Promptly remove (within 48 hours of their discovery) any deer or moose killed by vehicles on Dunka Road and the haul roads to limit the likelihood of wolves feeding on carrion on or near the road. Carcasses should be taken at least one-quarter mile away from Dunka Road or the haul roads.
4. Provide site safety training on identification of gray wolves to contractors and employee who would drive on the haul road.
5. Report any vehicle collisions with gray wolves to the local Superior National Forest office. These reports shall include all known information regarding the incident, including the species involved, date of incident, fate of the animal (e.g., dead, injured), location of the carcass, geographic coordinates of the accident location, sex of the animal, and approximate age (i.e., adult, juvenile).

6.0 References

- AECOM. 2009. 2009 NorthMet Mine/Forest Additional Parcel Northern Goshawk and Owl Survey – Final Report. Prepared for PolyMet Mining Corporation. Hoyt Lakes, Minnesota. Redmond, Washington.
- _____. 2011a. 2008 NorthMet Mine/Forest Service Additional Parcel Summer Wildlife and Wetland Assessment – Final Report. Report Prepared for PolyMet, Inc., Hoyt Lakes, Minnesota. Redmond, Washington.
- _____. 2011b. 2009 Hay Lakes Parcel and McFarland Parcel Summer Wildlife and Wetland Assessment Final Report. Prepared for PolyMet Mining Corporation, Hoyt Lakes, Minnesota. Redmond, Washington.
- _____. 2011c. Hunting Club, Lake County, and Wolf Land Parcels Fall 2010 Wildlife and Wetland Assessment Final Report. Report Prepared for PolyMet, Inc., Hoyt Lakes, Minnesota. Redmond, Washington.
- BAMONA. 2013. Butterflies and Moths of North America. Available at URL: <http://www.butterfliesandmoths.org/species/>.
- Barr Engineering Company. 2007a. Technical Memorandum: Results of Autumn 2007 Field Surveys for *Botrychium rugulosum* at PolyMet Mine Site. Report Prepared for PolyMet Mining Company, Hoyt Lakes, Minnesota. Minneapolis, Minnesota.
- _____. 2007b. Wetlands in the USFS Land Exchange Area. Memorandum dated 29 November 2007. Minneapolis, Minnesota.
- _____. 2007c. NorthMet Project. Facility Mercury Mass Balance Analysis (RS66). March 2007.
- _____. 2009a. Land Exchange Botanical Survey Conducted by Scott Milburn. Electronic Mail Correspondence between Daniel Jones, Barr Engineering, and Stuart Paulus, AECOM, Dated August 6, 2009. Minneapolis, Minnesota.
- _____. 2009b. Cumulative Effects Analysis of Wildlife Habitat and Threatened and Endangered Wildlife Species. Report Prepared for U.S. Steel, Keewatin, Minnesota. Minneapolis, Minnesota.
- _____. 2011. Summaries of Sensitive Species Surveys Conducted by MNRI and Additional Sensitive Species Locations from the MDNR NHIS Database. Minneapolis, Minnesota.
- _____. 2013. Supplemental Air Emissions Risk Analysis (AERA) – Plant Site. Version 3. March 25, 2013.
- Bell Museum of Natural History. 2013. Scientific Collections Database. Minneapolis, Minnesota. Available at URL: <http://www.bellmuseum.umn.edu/ResearchandTeaching/Collections/index.htm>.
- Berg, W.E., and D.W. Kuehn. 1982. Ecology of Wolves in North-central Minnesota. Pages 4-11 in *Wolves of the World: Perspectives of Behavior, Ecology, and Conservation* (F.H. Harrington and P.C. Paquet, Editors). Noyes, Park Ridge, New Jersey.

REFERENCES

- Berndt, M. E. 2003. Mercury and Mining in Minnesota. Final report, Minnesota Department of Natural Resources, St. Paul, MN 58p.
- Berndt, M. and T. Bavin. 2012. On the Cycling of Sulfur and Mercury in the St. Louis River Watershed, Northeastern Minnesota. An Environmental and Natural Trust Fund Final Report. Minnesota Department of Natural Resources, St. Paul, MN. August 15, 2012.
- _____, and S. Benson. 1998. Updated Wolf Population Estimate for Minnesota, 1997-98. Pages 85-98 in Summaries of Wildlife Research Findings, 1998 (B. Joselyn, Editor). Minnesota Department of Natural Resources, St. Paul.
- Boal, C.W., D.E. Andersen, and P.L. Kennedy. 2001. Home Range and Habitat Use of Northern Goshawks (*Accipiter gentilis*) in Minnesota. Final Report. Minnesota Cooperative Fish and Wildlife Research Unit, University of Minnesota, St. Paul, Minnesota.
- Bowen, K.D., and J.C. Gillingham. 2004. R9 Species Conservation Assessment for Wood Turtle – *Glyptemys insculpta* (LeConte, 1830). Iowa State University, Ames. Available at URL: http://www.fs.fed.us/r9/wildlife/tes/ca-overview/docs/reptile_Glyptemys_insculpta-Wood_Turtle.pdf.
- Breneman, D. 2005. Stream and Wetland Biological Survey, Proposed NorthMet Mining Project, Hoyt Lakes, Minnesota. Prepared for PolyMet Mining Corporation, Inc. by the Natural Resources Research Institute (NRRI) Center for Water and the Environment. NRRI Technical Report Number NRRI/TR-2005/05. Duluth, Minnesota.
- Broders, H.G., G.J. Forbes, S. Woodley and I.D. Thompson. 2006. Range Exent and Stand Selection for Roosting and Foraging in Forest-Dwelling Northern Long-Eared Bats and Little Brown Bats in the Greater Fundy Ecosystem, New Brunswick. Journal of Wildlife Management, 70: 1174 – 1184.
- Brzeskiewicz, M. 2000. Conservation Assessment for Ram's Head Lady Slipper (*Cypripedium arietinum*). Report Prepared for the USDA Forest Service Eastern Region, Milwaukee, Wisconsin. Available at URL: http://www.fs.fed.us/r9/wildlife/tes/ca-overview/docs/plant_Cypripedium_arietinum-Rams_Head_Lady_Slipper.pdf.
- _____, and D. Fields. 2003. Conservation Assessment for Braun's Holly Fern (*Polystichum braunii*). Report Prepared for the USDA Forest Service, Eastern Region, Milwaukee, Wisconsin. Available at URL: http://www.fs.fed.us/r9/wildlife/tes/ca-overview/docs/plant_Polystichum_braunii-Brauns_Holly_Fern.pdf.
- Buckman-Sewald, J., C.R. Whorton and K.V. Root. 2014. Developing Macrohabitat Models for Bats in Parks Using Maxent and Testing them with Data Collected by Citizen Scientists. International Journal of Biodiversity and Conservation, 6: 171 – 183.
- Burdett, C.L. 2002. Conservation Assessment for Three-toed Woodpecker (*Picoides tridactylus*). Report Prepared for the USDA Forest Service, Eastern Region, Milwaukee, Wisconsin. Univeristy of Minnesota, St. Paul. Available at URL: http://www.fs.fed.us/r9/wildlife/tes/ca-overview/docs/bird_Picoides_tridactylus-ThreeToedWoodpecker.pdf.

- Catton, S. 2007. Electronic Transmission on July 19, 2007. Mountain Lion, Goshawk, and Owl Questions. Kawishiwi Ranger District, Superior National Forest. Ely, Minnesota.
- Chadde, S., and G. Kudray. 2001a. Conservation Assessment for *Botrychium lunaria* (Common Moonwort). USDA Forest Service Eastern Region, Milwaukee, Wisconsin. Available at URL: http://www.fs.fed.us/r9/wildlife/tes/ca-overview/docs/plant_Botrychium_lunaria-Common_Moonwort.pdf.
- _____. 2001b. Conservation Assessment for Western Moonwort (*Botrychium hesperium*). USDA Forest Service Eastern Region, Milwaukee, Wisconsin. Available at URL: http://www.fs.fed.us/r9/wildlife/tes/ca-overview/docs/plant_Botrychium_hesperium-Western_Moonwort.pdf.
- _____. 2001c. Conservation Assessment for Narrow Triangle Moonwort (*Botrychium lanceolatum* var. *angustisegmentum*). Report Prepared for USDA Forest Service, Eastern Region, Milwaukee, Wisconsin. Available at URL: http://www.fs.fed.us/r9/wildlife/tes/ca-overview/docs/plant_Botrychium_lanceolatum-Narrow_Triangle_Moonwort.pdf.
- _____. 2003a. Conservation Assessment for Pale Moonwort (*Botrychium pallidum*). Prepared for the USDA Forest Service, Eastern Region, Milwaukee, Wisconsin. Available at URL: http://www.fs.fed.us/r9/wildlife/tes/ca-overview/docs/plant_Botrychium_pallidum-Pale_Moonwort.pdf.
- _____. 2003b. Conservation Assessment for Ternate Grapefern (*Botrychium rugulosum*). Prepared for the USDA Forest Service, Eastern Region, Milwaukee, Wisconsin. Available at URL: http://www.fs.fed.us/r9/wildlife/tes/ca-overview/docs/plant_Botrychium_rugulosum-Ternate_Grapefern.pdf.
- _____. 2003c. Conservation Assessment for Least Moonwort (*Botrychium simplex*). Prepared for the USDA Forest Service, Eastern Region, Milwaukee, Wisconsin. Available at URL: http://www.fs.fed.us/r9/wildlife/tes/ca-overview/docs/plant_Botrychium_simplex-Least_Moonwort.pdf.
- Chapman, K.A, G. Mickel, and A. Waltz. 2014. Northern Long-Eared Bat (*Myotis septentrionalis*) in Northern Minnesota: Findings and Research Agenda. Applied Ecological Services, Inc., Prior Lake, MN. October 15, 2014.
- Coffin, B., and L. Pfannmuller, Editors. 1988. Minnesota's Endangered Flora and Fauna. University of Minnesota Press and Minnesota Department of Natural Resources. St. Paul.
- Council on Environmental Quality. 2005. Council on Environmental Quality. 2005. Guidance on the Consideration of Past Actions in Cumulative Effects Analysis. Memorandum from J. Connaughton, Chairman. Washington, D.C.
- Eggers, S.D., and D.M. Reed. 1997. Wetland Plants and Communities of Minnesota and Wisconsin. U.S. Army Corps of Engineers, St. Paul District. Jamestown, North Dakota. Northern Prairie Wildlife Research Center Online. Available at URL: <http://www.npwrc.usgs.gov/resource/plants/mnplant/index.htm>.

REFERENCES

- Emmons and Olivier Resources, Inc. 2006. Cumulative Effects Analysis on Wildlife Habitat and Corridors in the Mesabi Iron Range and Arrowhead Regions of Minnesota. Prepared for the Minnesota Department of Natural Resources, St. Paul, Minnesota.
- ENSR. 2000. Winter 2000 Wildlife Survey for the Proposed NorthMet Mine Site, St. Louis County, Minnesota. Redmond, Washington.
- _____. 2005. NorthMet Mine Summer Fish and Wildlife Study. Report Prepared for Barr Engineering, Inc., Minneapolis, Minnesota. Redmond, Washington.
- Erb, J. 2008. Distribution and Abundance of Wolves in Minnesota, 2007-08. Minnesota Department of Natural Resources. St. Paul, Minnesota. Available at URL:
http://files.dnr.state.mn.us/fish_wildlife/wildlife/wolves/2008_survey.pdf.
- _____, and B. Sampson. 2013. Distribution and Abundance of Wolves in Minnesota, 2012-13. Minnesota Department of Natural Resources, St. Paul.
- Estabrook, T. 2000. Species Data Form, *Accipiter gentilis atricapillus*. On File at USDA Forest Service, Duluth, Minnesota.
- Fenton, M. B., & Barclay, R. M. R. 1980. *Myotis lucifugus*. Mammalian Species, 142, 1-8.
- Flake, L.D. and K.L. Cieminski. 1996. Waterfowl Use of Wastewater Ponds on the Idaho National Engineering Laboratory. In F. Webb, ed. Proceedings of the Twenty-third Annual Conference on Ecosystem Restoration and Creation. May 16-17. Hillsborough Community College, Tampa, Florida.
- Ford, W.M., M.A. Menzel, J.L. Rodrigue, J.M. Menzel and J.B. Johnson. 2005. Relating Bat Species Presence to Simple Habitat Measures in a Central Appalachian Forest. Biological Conservation, 126: 528 – 539.
- Francel, K.E. 2008. Summer Bat Activity at Woodland Seasonal Pools in the Northern Great Lakes Region. Wetlands 28: 117 – 124.
- Fuller, T.K. 1989. Population Dynamics of Wolves in North Central Minnesota. Wildlife Monographs 105.
- _____. 1997. Guidelines for Gray Wolf Management in the Northern Great Lakes Region. International Wolf Center Publication No. IWC97-271. Ely, Minnesota.
- _____, W.E. Berg, G.L. Radde, M.S. Lenarz, and G.B. Joselyn. 1992. A History and Current Estimate of Wolf Distribution and Numbers in Minnesota. Wildlife Society Bulletin 20:42-54.
- Fulton, S.A., L.E. Dodd and L.K. Rieske. 2014. Hydric Habitats are Important to Foraging Bats in the Bluegrass Region's Urban Parks. Urban Naturalist, 3: 1-13.
- Grandmaison, D.D., K. Kirschbaum, and T. Catton. 2013. Superior National Forest Bat Monitoring: Summary of 2013 Survey Effort. Superior National Forest, U.S. Forest Service, Department of Agriculture. Ely, Minnesota.

- Gray, M.J., H.M. Hagy, J.A. Nyman and J.D. Stafford. 2013. Chapter 4, Management of Wetlands for Wildlife. U.S. Geological Survey Staff – Published Research, Paper 803.
- Green, J.C. 1995. Birds and Forests, a Management and Conservation Guide. Minnesota Department of Natural Resources, St. Paul, Minnesota.
- _____. 2003. Birds of the Superior National Forest: An Annotated Checklist. Boundary Waters Wilderness Foundation. Minneapolis, Minnesota.
- Hayward, G.D. 1994. Review of Technical Knowledge: Boreal Owl. Pages 92-127 in USDA Forest Service General Technical Report RM-253 (G.D. Hayward and J. Verner, Technical Editors). Fort Collins, Colorado.
- Heath, D.J. 2004. Results of an October 2004 Freshwater Mussel (Mollusca: Bivalvia: Unionidae) Survey in Trimble Creek, Partridge and Embarrass Rivers Near the Proposed NorthMet Mine Project, Northeastern Minnesota. Prepared for Barr Engineering Company, Minneapolis, Minnesota.
- _____. 2011. Results of a September 2009 Freshwater Mussel (Mollusca: Bivalvia: Unionidae) Survey in the Partridge River near the Proposed NorthMet Mine Project, Northeastern Minnesota - Final. Report Prepared for Barr Engineering Company, Minneapolis, Minnesota.
- Henderson, L. and H. Broders. 2008. Movements and Resource Selection of the Northern Long-eared Myotis (*Myotis septentrionalis*) in a Forest-agriculture Landscape. *Journal of Mammology*, 89 (4): 952-963.
- Hill, S. 2003. Conservation Assessment for Barren Strawberry (*Waldsteinia fragarioides* ssp. *fragarioides*) Report Prepared for the USDA Forest Service, Eastern Region, Milwaukee, Wisconsin. Available at URL: http://www.fs.fed.us/r9/wildlife/tes/ca-overview/docs/plant_Waldsteinia_fragarioides-Barren_Strawberry.pdf.
- Hoy, J. 2001. Conservation Assessment for Auricles Twayblade (*Listera auriculata*). Report Prepared for the New England Wild Flower Society, Framingham, Massachusetts. Auburn, New Hampshire. Available at URL: http://www.fs.fed.us/r9/wildlife/tes/ca-overview/docs/plant_Listera_auriculata-Auricled_Twayblade.pdf.
- International Wolf Center. 2012. Wolf Telemetry Database. Ely, Minnesota.
- Jaakko Poyry Consulting, Inc. 1994. Proposed Final Generic Environmental Impact Statement Study on Timber Harvesting and Forest Management in Minnesota. Prepared for the Minnesota Environmental Quality Board, St. Paul, Minnesota. Available at URL: <http://iic.gis.umn.edu/download/geis/main/geismain.htm>.
- Jannett, F.J. 2006. The Heather Vole (*Phenacomys intermedius*) on Superior National Forest, 2006: Additional Records, an Additional Locality, and Patterns of Trappability. Report Submitted to the U.S. Forest Service. 15pp.
- Jantzen, M.K. 2012. Bats and the Landscape: The Influence of Edge Effects and Forest Cover on Bat Activity. Masters of Science Thesis. School of Graduate and Postdoctoral Studies, University of Western Ontario, London, Ontario, Canada.

REFERENCES

- Johnson-Groh, C. 2004. *Botrychium* (Moonwort) Rare Plant Surveys for PolyMet Project. Prepared for Barr Engineering Company, Minneapolis, Minnesota.
- Judd, L. 2013. Effects of Mercury (Hg) and Methylmercury (MeHg) on Bald Eagle (*Haliaeetus leucocephalus*) Populations in the Great Lakes Region. Memo to MDNR regarding NorthMet Project, February 5, 2013.
- Kozie, K. 1999. Species Data Form, *Strix nebulosa*. On File at USDA Forest Service, Duluth, Minnesota.
- Kudell-Ekstrum, J. 2002. Conservation Assessment for Connecticut Warbler (*Oporornis agilis*). 2002. Report Prepared for the USDA Forest Service, Eastern Region, Milwaukee, Wisconsin. Hiawatha National Forest, Gladstone, Michigan. Available at URL: http://www.fs.fed.us/r9/wildlife/tes/ca-overview/docs/bird_Oporornis_agilis-ConnecticutWarbler.pdf.
- Lookingbill, T.R., A.J. Elmore, K.A.M. Engelhardt, J.B. Churchill, J.E. Gates and J.B. Johnson. 2010. Influence of Wetland Networks on Bat Activity in Mixed-Use Landscapes. *Biological Conservation*, 143: 974 – 983.
- MacLean, S. 1999. Species Data Collection Form, *Conturnicops noveboracensis*. On File at USDA Forest Service, Duluth, Minnesota.
- Marr, C. 2008. Contaminants in Fish and Wildlife of Lynx Lake, Arizona. USFWS Region 2.
- Master, L.L., B.A. Stein, L.S. Kutner, and G.A. Hammerson. 2000. Vanishing Assets: Conservation Status of U.S. Species. *In* Precious heritage: The Status of Biodiversity in the United States (B.A. Stein, L.S. Kutner, and J.S. Adams, Editors). Oxford University Press, New York.
- Maxson, G. 1999. Species Data Form, *Dendroica castanea*. On File at USDA Forest Service, Duluth, Minnesota.
- Mayasich, J.M., and G.J. Niemi. 2002. Conservation Assessment for Bay-breasted Warbler (*Dendroica castanea*). Report Prepared for the USDA Forest Service, Eastern Region, Milwaukee, Wisconsin. Natural Resources Research Institute, University of Minnesota, St. Paul. Available at URL: http://www.fs.fed.us/r9/wildlife/tes/ca-overview/docs/bird_Dendroica_castanea-BayBreastedWarbler.pdf
- McAllister J.A., and R.S. Hoffmann. 1988. Mammalian Species No. 305, *Phenacomys intermedius*. The American Society of Mammalogists.
- Mech, L.D. 1970. The Wolf: The Ecology and Behavior of an Endangered Species. The Natural History Press, Garden City, New York.
- _____. 1974. *Canis lupus*. Mammalian Species 37. American Society of Mammalogy.
- Milburn, S.A., and J. Husveth. 2004. Conservation Assessment for Lance-leaved Violet (*Viola lanceolata* L. var. *lanceolata*). Critical Connections Ecological Services, Inc., Marine on Saint Croix, Minnesota. Available at URL: [http://www.fs.fed.us/r9/wildlife/tes/ca-overview/docs/Violan_CA_Final .pdf](http://www.fs.fed.us/r9/wildlife/tes/ca-overview/docs/Violan_CA_Final.pdf).

- Minnesota Department of Natural Resources (MDNR). 1989. Limnological Characteristics of Mine Pit lakes in Northeast Minnesota. Section of Fisheries, Investigational Report No. 399. November 1989. 54 pp.
- _____. 2006. GAP Land Cover-vector. Data Deli. St. Paul, Minnesota.
- _____. 2008. Rare Species Guide: An Online Encyclopedia of Minnesota's Rare Native Plants and Animals [Web Application]. Division of Ecological and Water Resources, Minnesota Department of Natural Resources, St. Paul, Minnesota. www.dnr.state.mn.us/rsg. Accessed 2013.
- _____. 2013a. 2013 Wolf Survey FAQs. St. Paul, Minnesota. Available at URL: http://files.dnr.state.mn.us/fish_wildlife/wildlife/wolves/2013/wolfsurveyfaq_2013.pdf.
- _____. 2013b. 2013 Wolf Season Application Information. St. Paul, Minnesota. Available at URL: http://files.dnr.state.mn.us/recreation/hunting/wolf/wolf_application.pdf.
- _____, U.S. Army Corps of Engineers, and USDA Forest Service. 2013. NorthMet Mining Project and Land Exchange Draft Supplemental Environmental Impact Statement. St. Paul, Minnesota.
- _____. 2014a. Natural Heritage Information System. Division of Ecological and Water Resources, Minnesota Department of Natural Resources, St. Paul, Minnesota.
- _____. 2014b. Minnesota Threatened and Endangered Species. Wood Turtle (*Glyptemys insculpta*, *Clemmys insculpta*). Species Profile. Downloaded December 2014. Available at URL: <http://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=ARAAD02020>
- _____. 2014c. Minnesota Threatened and Endangered Species. Wood Turtle (*Glyptemys insculpta*, *Clemmys insculpta*). Species Profile. Downloaded December 2014. Available at URL: <http://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=ARAAD02020>
- Minnesota Pollution Control Agency. A Guide to Noise Control in Minnesota: Acoustical Properties, Measurement, Analysis, Regulation. Revised March 1999.
- Minnesota Forest Resources Council. 1999. Minnesota Northeast Landscape Conditions and Trends Assessment. Document LT-0799. St. Paul, Minnesota.
- _____. 2003. Changes in Forest Spatial Patterns from the 1930s to the Present in North Central and Northeastern Minnesota. An Analysis of Historic and Recent Air Photos. Minnesota Forest Resources Council Report LT-1203c. St. Paul, Minnesota.
- Minnesota Wildflowers. 2013. Minnesota Wildflowers. Available at URL: <http://www.minnesotawildflowers.info/>.
- Mladenoff, D.J., T.A. Sickley, R.G. Haight, and A.P. Wydeven. 1995. Regional Landscape Analysis and Prediction of Favorable Gray Wolf Habitat I Northern Great Lakes Region. Conservation Biology 9:279-294.
- Naylor, B. J., Bendell, J. F., and Spires, S. 1985. High Density of Heather Voles, *Phenacomys intermedius*, in Jack Pine, *Pinus banksiana*, Forests in Ontario. Canadian Field Naturalist 99:494-497.

REFERENCES

- Nelms, K.D. 2007. Wetland Management for Waterfowl Handbook. Natural Resources Conservation Service, Mississippi; Mississippi River Trust; United States Fish and Wildlife Service. Bethesda, Maryland.
- Nelms K.D, M.D. Porter, and M.J. Gray. 2012. Managing Small Impoundments for Wildlife, Chapter 16. pp 391–420. In: Neal, W., ed. Small impoundment management in North America. American Fisheries Society, Bethesda, Maryland.
- Niemi, G.J., and J.M. Hanowski. 1992. Forest Wildlife, Forest Birds Section. *In* Proposed Final Generic Environmental Impact Statement Study on Timber Harvesting and Forest Management in Minnesota. Prepared by Jaakko Poyry, Consulting for the Environmental Quality Board.
- Poly Met Mining, Inc. 2013. NorthMet Project Revised Wetland Permit Application (v1). Issued August, 2013.
- _____. 2014a. NorthMet Project Wetland Data Package (v8). November, 2014.
- _____. 2014b. NorthMet Project, Project Description (v8). December 12, 2014.
- _____. 2014c. NorthMet Project Water Management Plan – Mine Site (v3). December 31, 2014.
- _____. 2014d. NorthMet Project Water Management Plan – Plant (v3). December 2014.
- _____. 2014e. NorthMet Project Residue Management Plan (v4). December 12, 2014.
- _____. 2014f. NorthMet Project Rock and Overburden Management Plan (v6). December 15, 2014.
- _____. 2014g. NorthMet Project Water Modeling Data Package – Mine Site (v13). December 29, 2014.
- _____. 2015. NorthMet Project Water Modeling Data Package – Plant Site (v10). January 2015.
- Pomroy, D., and R. Barnes 2004. Rare Plant Survey at the PolyMet Mine Site Located in Township 59 North, Range 13 West. Prepared for Barr Engineering Company, Minneapolis, Minnesota.
- Rieck, K. 1999. Species Data Form, *Oporonis agilis*. On File at USDA Forest Service, Duluth, Minnesota.
- Robbins, C.S., D.K. Dawson, and B.A. Dowell. 1989. Habitat Area Requirements of Breeding Forest Birds of the Middle Atlantic States. Wildlife Monographs 103:1-34.
- Russ, W.P. 2009. Electronic Transmission on January 21, 2010 to Stuart Paulus, AECOM Regarding Status of Species of Concern Near McFarland Lake, Cook County, Minnesota. Wildlife Biologist, Laurentian Ranger District, Superior National Forest, Aurora, Minnesota.
- Ryan, D. 2011. Biologist, USDA Forest Service, Aurora, Minnesota. Electronic Mail Communication with S. Paulus, AECOM, Seattle, Washington, Regarding RFSS Species on the Superior National Forest, December 20, 2011.
- _____. 2013a. Biologist, USDA Forest Service, Aurora, Minnesota. Electronic Mail Communication with S. Paulus, AECOM, Seattle, Washington, Regarding RFSS Species, August 6, 2013.

-
- _____. 2013b. Biologist, USDA Forest Service, Aurora, Minnesota. Electronic Mail Communication with S. Paulus, AECOM, Seattle, Washington, Regarding Great Gray Owl and Northern Goshawk Nest Sites on the Superior National Forest, July 10, 2013.
- _____. 2013c. Biologist, USDA Forest Service, Aurora, Minnesota. Electronic Mail Communication with S. Paulus, AECOM, Seattle, Washington, Regarding Boreal Owl Nest Site in Lake County, Minnesota, November 18, 2013.
- Sauer, J. R., J.E. Hines, J.E. Fallon, K.L. Pardieck, D.J. Ziolkowski, Jr., and W.A. Link. 2012. The North American Breeding Bird Survey, Results and Analysis 1966 - 2011. Version 07.03.2013. U.S. Geological Survey Wildlife Research Center, Laurel, Maryland. Available at URL: <http://www.mbr-pwrc.usgs.gov/bbs/>.
- Schmidt, L.J. 2003a. Conservation Assessment for *Calypso bulbosa* Fairy Slipper. Ely, Minnesota. Available at URL: <http://www.fs.fed.us/r9/wildlife/tes/ca-overview/docs/Plants/Fairy%20Slipper.pdf>.
- _____. 2003b. Conservation Assessment for *Polemonium occidentale* v. *lacustre* Western Jacob's Ladder. Ely, Minnesota. Available at URL: <http://www.fs.fed.us/r9/wildlife/tes/ca-overview/docs/Plants/W%20Jacobs%20Ladder.pdf>.
- Seger, K.R., P.C.Smiley, K.W. King and N.R. Fausey. 2012. Influence of Riparian Habitat on Aquatic Macroinvertebrate Community Colonization Within Riparian Zones of Agricultural Headwater Streams. *Journal of Freshwater Ecology*, DOI:10.1080/02705060.2012.662470: 1 – -15.
- Shackelford, R. 2004. Conservation Assessment for New England Sedge (*Carex novae-angliae* Schwein.). Report Prepared for the USDA Forest Service, Eastern Region, Milwaukee, Wisconsin. Available at URL: http://www.fs.fed.us/r9/wildlife/tes/ca-overview/docs/Plants/Carex_Novae-Angliae.pdf.
- Squires, J.R., and R.T. Reynolds. 1997. Northern Goshawk (*Accipiter gentilis*). In *The Birds of North America*, No. 298 (A. Poole and F. Gill, Editors). The Academy of Natural Sciences, Philadelphia, Pennsylvania, and The American Ornithologists' Union, Washington, D.C.
- U.S. Army Corps of Engineers (USACE) and U.S. Department of Agriculture Forest Service. 2013. NorthMet Mining Project and Land Exchange Biological Assessment Draft. St. Paul, Minnesota.
- U.S. Department of Agriculture Forest Service (USDA Forest Service). 1999. Environmental Assessment for the Reservoir Analysis Area. Superior National Forest Laurentian Ranger District, Aurora, Minnesota.
- _____. 2000a. Forest Service Directives. Forest Service Manuals. Series 2000 Natural Resource Management. 2600 - Wildlife, Fish, and Sensitive Plant Habitat Management. Available at URL: <http://www.fs.fed.us/im/directives/dughtml/fsm2000.html>.
- _____. 2000b. Forest Stand Species and Age Maps. Superior National Forest Laurentian Ranger District, Aurora, Minnesota.
- _____. 2002. Conservation Assessment for Port-hole Lichen (*Menegazzia terebrata*). Eastern Region, Milwaukee, Wisconsin. Available at URL: http://www.fs.fed.us/r9/wildlife/tes/ca-overview/docs/nonvascularplants_Menegazzia-terebrata-Port_Hole_Lichen.pdf.

REFERENCES

- _____. 2004a. Land and Resource Management Plan for the Superior National Forest. Eastern Region, Milwaukee, Wisconsin. Available at URL: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsm91_050593.pdf.
- _____. 2004b. 2004 Forest Plan Revision Final Environmental Impact Statement for Chippewa and Superior National Forests. Eastern Region, Milwaukee, Wisconsin. Available at URL: http://www.fs.usda.gov/detail/superior/landmanagement/planning/?cid=fsm91_049717.
- _____. 2004c. Forest Plan Revision Chippewa and Superior National Forests Regional Forester Sensitive Plants Biological Evaluation. Duluth, Minnesota. Available at URL: http://www.fs.usda.gov/detail/superior/landmanagement/planning/?cid=fsm91_049717.
- _____. 2004d. Forest Plan Revision Chippewa and Superior National Forests Regional Forester Sensitive Animals Biological Evaluation. Duluth, Minnesota. Available at URL: http://www.fs.usda.gov/detail/superior/landmanagement/planning/?cid=fsm91_049717.
- _____. 2004e. *Juncus stygius* var. *americanus* Buchenau (Moor Rush, Bog Rush). Eastern Region, Hiawatha National Forest, Gladstone, Michigan. Available at URL: <http://www.fs.fed.us/r9/wildlife/tes/ca-overview/docs/Juncus%20stygius%20var.%20amer.pdf>.
- _____. 2006. Whyte Forest Management Project Laurentian Ranger District, Superior National Forest Biological Evaluation Region 9 Regional Forester Sensitive Species. Ely, Minnesota. 2006. _____. 2010a. USFS Management Indicator Habitat Data. Accessed on October 21, 2011.
- _____. 2010b. Tracks Forest Management Project Laurentian Ranger District, Superior National Forest Biological Evaluation Region 9 Regional Forester Sensitive Species. Aurora, Minnesota. Available at URL: http://www.fs.usda.gov/wps/portal/fsinternet!/ut/p/c4/04_SB8K8xLLM9MSSzPy8xBz9CP0os3hvXxMjMz8Dc0P_kFALA09zLzNDowAXYwMLE_2CbEdFANocRhE!/?project=28862.
- _____. 2012. Regional Forester Sensitive Species Biological Evaluation for the Federal Hardrock Minerals Prospecting Permits Draft Environmental Impact Statement. Superior National Forest, Ely, Minnesota. Available at URL: http://a123.g.akamai.net/7/123/11558/abc123/forestservic.download.akamai.com/11558/www/nepa/31175_FSPLT2_126775.pdf.
- _____. 2014a. Summary of Acoustic and Emergence Surveys for Bats in the NothMet Project Area. USDA Superior National Forest, Kawishiwi Ranger District. Ely, Minnesota.
- _____. 2014b. Summary of the 2014 Minnesota Northern Long-eared Bat Summer Habitat Use in Minnesota Project (Preliminary Report). USDA Superior National Forest, Kawishiwi Ranger District. Ely, Minnesota.
- U.S. Environmental Protection Agency. NTID300.1 Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances, Figure 1. December 31, 1971. Washington, D.C.

- U.S. Department of the Interior (USDO), U.S. Fish and Wildlife Service (USFWS). 2007. National Bald Eagle Management Guidelines. Washington, D.C. Available at URL: <http://www.fws.gov/mississippiES/pdf/Eagle%20Guidelines.pdf>.
- _____. 2013. Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition To List the Eastern Small-Footed Bat and the Northern Long-eared Bat as Endangered or Threatened Species; Listing the Northern Long-Eared Bat as an Endangered Species; Proposed Rule. October 2, 2013. 50 Code of Federal Regulations Part 17, Volume 78, Number 191, Pages 61046-61080. Washington, D.C.
- _____. 2014. Northern Long-eared Bat Interim Conference and Planning Guidance. USFWS Regions 2, 3, 4, 5, & 6. January 6, 2014. Washington, D.C.
- _____. 2015. Endangered and Threatened Wildlife and Plants; Threatened Species Status for the Northern Long-Eared Bat with 4(d) Rule; Final Rule and Interim Rule.
- U.S. Geological Survey National Wildlife Health Center. 2013. White-nosed Syndrome. Madison, Wisconsin. Available at URL: http://www.nwhc.usgs.gov/disease_information/white-nose_syndrome/.
- Walton, G.B. 2004. Rare Plant Species Survey. Report Prepared for Barr Engineering, Inc., Minneapolis, Minnesota.
- Wetmore, C. 2002a. Conservation Assessment for *Sticta fuliginosa* (Hoffm.) Ach. Report Prepared for the USDA Forest Service Eastern Region, Milwaukee, Wisconsin. St. Paul, Minnesota. Available at URL: http://www.fs.fed.us/r9/wildlife/tes/ca-overview/docs/nonvascularplants_Sticta_fuliginosa-none.pdf.
- _____. 2002b. R9 Species Conservation Assessment for *Usnea longissima* Ach. in the Upper Great Lakes National Forests. St. Paul, Minnesota. Available at URL: <http://www.fs.fed.us/r9/wildlife/tes/ca-overview/docs/Nonvascular%20Plants/Usnea%20longissima.pdf>.
- _____. 2002c. Conservation Assessment for (*Caloplaca parvula*) Wetm. Report Prepared for USDA Forest Service Eastern Region, Milwaukee, Wisconsin. St. Paul, Minnesota. Available at URL: http://www.fs.fed.us/r9/wildlife/tes/ca-overview/docs/nonvascularplants_caloplaca_parvula.pdf.
- _____. 2002d. Conservation Assessment for (*Cetraria aurescens*) Tuck. Report Prepared for the USDA Forest Service Eastern Region. St. Paul, Minnesota. Available at URL: http://www.fs.fed.us/r9/wildlife/tes/ca-overview/docs/nonvascularplants_Cetraria_aurescens-none.pdf.
- _____. 2002e. Conservation Assessment for *Peltigera venosa* (L.) Hoffm. Report Prepared for USDA Forest Service, Eastern Region, Milwaukee, Wisconsin. St. Paul, Minnesota. Available at URL: http://www.fs.fed.us/r9/wildlife/tes/ca-overview/docs/nonvascularplants_Peltigera_venosa-none.pdf.
- Wisconsin Department of Natural Resources. 1999. Wisconsin Wolf Management Plan. October 27, 1999. Madison, Wisconsin.
- _____. 2013. Wisconsin Little Brown Bat Species Guidance. Bureau of Natural Heritage Conservation, Wisconsin Department of Natural Resources, Madison, Wisconsin. PUB-ER-705. 11 pp.

REFERENCES

- Wolf, A. 2002. Conservation Assessment for Northern Blue Butterfly –*Plebejus (Lycaeides) idas nabokovi* Masters and Dwarf Bilberry – *Vaccinium caespitosum* (Michx). Prepared for the USDA Forest Service, Eastern Region, Milwaukee, Wisconsin. Cofrin Center for Biodiversity, University of Wisconsin-Green Bay, Wisconsin. Available at URL: [http://www.fs.fed.us/r9/wildlife/tes/ca-overview/docs/insect_Plebejus \(Lycaeides\) idas nabokovi-NoBlueButterfly.pdf](http://www.fs.fed.us/r9/wildlife/tes/ca-overview/docs/insect_Plebejus_(Lycaeides)_idas_nabokovi-NoBlueButterfly.pdf).

APPENDIX A

Common and Scientific Names of Plants and Animals Given in this Biological Evaluation

Common Name	Scientific Name
Plants	
A Lichen	<i>Caloplaca parvula</i>
A Lichen	<i>Cetraria aurescens</i>
American Shoreweed	<i>Littorella uniflora</i>
American Waterawlwort	<i>Subularia aquatica</i>
Alpine Milkvetch	<i>Astragalus alpinus</i>
Appalachian Clubmoss	<i>Huperzia appalachiana</i>
Arctoparmelia Lichen	<i>Arctoparmelia centrifuga</i>
Arctoparmelia Lichen	<i>Arctoparmelia subcentrifuga</i>
Arrowhead	<i>Sagittaria latifolia</i>
Auricled Twayblade	<i>Listera auriculata</i>
Balsam Fir	<i>Abies balsamea</i>
Barren Strawberry	<i>Waldsteinia fragariodes</i>
Basswood	<i>Tilia americana</i>
Beaked Hazel	<i>Corylus cornuta</i>
Beard Lichen	<i>Usnea longissima</i>
Black Ash	<i>Fraxinus nigra</i>
Black Spruce	<i>Picea mariana</i>
Blueberry	<i>Vaccinium angustifolium</i>
Bog Birch	<i>Betula pumila</i>
Bog Labrador-tea	<i>Ledum groenlandicum</i>
Bog Muhly	<i>Muhlenberia uniflora</i>
Bog Rosemary	<i>Andromedia polifolia</i>
Bog White Violet	<i>Viola lanceolata</i>
Braun's Holly Fern	<i>Polystichum braunii</i>
Bullrush	<i>Scirpus</i> sp.
Canada Bluejoint	<i>Calamagrostis canadensis</i>
Canada Ricegrass	<i>Piptatherum canadense</i>
Canada Yew	<i>Taxus canadensis</i>
Cartilage Lichen	<i>Ramalina thrausta</i>
Cattail	<i>Typha</i> spp.
Chilean Sweet-cicely	<i>Osmorhiza berteroi</i>
Cloudberry	<i>Rubus chamaemorus</i>
Clubmoss	<i>Lycopodium</i> spp.
Common Moonwort	<i>Botrychium lunaria</i>
Creeping Rush	<i>Juncus subtilis</i>
Creeping Snowberry	<i>Gaultheria hispidula</i>
Douglas' Hawthorn	<i>Crataegus douglasii</i>

APPENDIX A (Cont.)

Common and Scientific Names of Plants and Animals Given in the Report

Common Name	Scientific Name
Plants (Cont.)	
Dwarf Bilberry	<i>Vaccinium cespitosum</i>
Eastern White Pine	<i>Pinus strobus</i>
Encrusted Saxifrage	<i>Saxifraga paniculata</i>
Fairy Slipper	<i>Calypso bulbosa</i>
Fan Lichen	<i>Peltigera venosa</i>
Floating Marsh Marigold	<i>Caltha natans</i>
Honeycombed Lichen	<i>Menegazzia terebrata</i>
Jack Pine	<i>Pinus banksiana</i>
Lanceleaf Grapefern	<i>Botrychium lanceolatum</i> var. <i>angustisegmentum</i>
Largeleaf Sandwort	<i>Moehringia macrophylla</i>
Least Moonwort	<i>Botrychium simplex</i>
Leatherleaf	<i>Chamaedaphne calyculata</i>
Leiberg's Waterlily	<i>Nymphaea leibergii</i>
Linear-leaved Sundew	<i>Drosera linearis</i>
Little Goblin Moonwort	<i>Botrychium mormo</i>
Long-leaved Arnica	<i>Arnica lonchophylla</i>
Maidenhair Spleenwort	<i>Asplenium trichomanes</i>
Michigan Moonwort	<i>Botrychium michiganense</i>
Moor Rush	<i>Juncus stygius</i>
Moschatel	<i>Adoxa moschatellina</i>
Narrow-leaved Cattail	<i>Typha latifolia</i>
New England Sedge	<i>Carex novae-angliae</i>
Nodding Saxifrage	<i>Saxifraga cernua</i>
Northern White Cedar	<i>Thuja occidentalis</i>
Oakes' Pondweed	<i>Potamogeton oakesianus</i>
Pale Moonwort	<i>Botrychium pallidum</i>
Paper Birch	<i>Betula papyrifera</i>
Peppered Moon Lichen	<i>Sticta fuliginosa</i>
Pussywillow	<i>Salix discolor</i>
Quill Spikerush	<i>Eleocharis nitida</i>
Ram's Head Lady Slipper	<i>Cypripedium arietinum</i>
Raspberry	<i>Rubus</i> spp.
Red Oak	<i>Quercus rubra</i>
Red-osier Dogwood	<i>Cornus stolonifera</i>
Red Pine	<i>Pinus resinosa</i>
Roughfruit Fairybells	<i>Prosartes trachycarpa</i>
Scotch False Asphodel	<i>Tofieldia pusilla</i>

APPENDIX A (Cont.)

Common and Scientific Names of Plants and Animals Given in the Report

Common Name	Scientific Name
Plants (Cont.)	
Sedge	<i>Carex</i> spp.
Selwyn's Scalewort	<i>Frullania selwyniana</i>
Shining Clubmoss	<i>Lycopodium lucidulum</i>
Short Sedge	<i>Carex rossii</i>
Small Beggarticks	<i>Bidens discoidea</i>
Small-fruited Bog Cranberry	<i>Vaccinium oxycoccus</i>
Smooth Woodsia	<i>Woodsia glabella</i>
Snowline Wintergreen	<i>Pyrola minor</i>
Sphagnum Moss	<i>Sphagnum</i> spp.
Speckled Alder	<i>Alnus rugosa</i>
Sticky Locoweed	<i>Oxytropis borealis</i> var. <i>viscida</i>
Sugar Maple	<i>Acer saccharum</i>
Tamarack	<i>Larix laricina</i>
Ternate Grapefern	<i>Botrychium rugulosum</i>
Three-seeded Bog Sedge	<i>Carex trisperma</i>
Three-leaved False Solomon's Seal	<i>Smilacia trifolia</i>
Trembling Aspen	<i>Populus tremuloides</i>
Triangle Grapefern	<i>Botrychium lanceolatum</i>
Wain's Cup Lichen	<i>Cladonia wainioi</i>
Western Jacob's-ladder	<i>Polemonium occidentale</i> ssp. <i>lacustre</i>
White Pine	<i>Pinus strobus</i>
White Spruce	<i>Picea glauca</i>
Wild Rice	<i>Zizania</i> spp.
Willow	<i>Salix</i> spp.
Woolgrass	<i>Scirpus cyperinus</i>
Yellow Specklebelly	<i>Pseudocyphellaria crocata</i>
Animals	
Bald Eagle	<i>Haliaeetus leucocephalus</i>
Bay-breasted Warbler	<i>Dendroica castanea</i>
Beaver	<i>Castor canadensis</i>
Big Brown Bat	<i>Eptesicus fuscus</i>
Black Sandshell	<i>Ligumia recta</i>
Boreal Owl	<i>Aegolius funereus</i>
Brown-headed Cowbird	<i>Molothrus ater</i>
Canada Lynx	<i>Lynx canadensis</i>
Common Raven	<i>Corvus corax</i>
Connecticut Warbler	<i>Oporornis agilis</i>

APPENDIX A (Cont.)

Common and Scientific Names of Plants and Animals Given in the Report

Common Name	Scientific Name
Animals (Cont.)	
Creek Heelsplitter	<i>Lasmigona compressa</i>
Eastern Heather Vole	<i>Phenacomys ungava</i>
Eastern Red Bat	<i>Lasiurus borealis</i>
Ebony Boghaunter	<i>Williamsonia fletcheri</i>
Fisher	<i>Martes pennanti</i>
Freija' Grizzled Skipper	<i>Pyrgus centaureae freija</i>
Gray Wolf	<i>Canis lupus</i>
Great Gray Owl	<i>Strix nebulosa</i>
Great Horned Owl	<i>Bubo virginianus</i>
Headwaters Chilostigman Caddisfly	<i>Chilostigma itascae</i>
Hoary Bat	<i>Lasiurus cinereus</i>
Moose	<i>Alces alces</i>
Lake Sturgeon	<i>Acipenser fulvescens</i>
Little Brown Myotis	<i>Myotis lucifugus</i>
Nabokov's Blue	<i>Plebejus idas nabokovi</i>
Nipigon Cisco	<i>Coregonus nipigon</i>
Northern Brook Lamprey	<i>Ichthyomyzon fossor</i>
Northern Goshawk	<i>Accipiter gentilis</i>
Northern Long-eared Bat	<i>Myotis septentrionalis</i>
Olive-sided Flycatcher	<i>Contopus cooperi</i>
Passenger Pigeon	<i>Ectopistes migratorius</i>
Quebec Emerald	<i>Somatochlora brevicincta</i>
Raccoon	<i>Procyon lotor</i>
Red-tailed Hawk	<i>Buteo jamaicensis</i>
Ruffed Grouse	<i>Bonasa umbellus</i>
Shortjaw Cisco	<i>Coregonus zenithicus</i>
Silver-haired Bat	<i>Lasionycteris noctivagans</i>
Snowshoe Hare	<i>Lepus canadensis</i>
Spruce Budworm	<i>Choristoneura fumiferana</i>
Taiga Alpine	<i>Erebia mancinus</i>
Three-toed Woodpecker	<i>Picoides tridactylus</i>
Tri-colored Bat	<i>Perimyotis subflavus</i>
White-tailed Deer	<i>Odocoileus virginianus</i>
Wood Turtle	<i>Glyptemys insculpta</i>